INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT VOLUNTARY REMEDIATION PROGRAM

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INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT VOLUNTARY REMEDIATION PROGRAM

INTRODUCTION

Indiana was one of the first states to address, through statutes, the liability issues associated with buying, selling or developing property contaminated by hazardous substances. In response to the growing need for the Indiana Department of Environmental Management's (IDEM) review and oversight of voluntary investigations and response actions, primarily involving property transactions, the Voluntary Remediation Program (VRP) was established in 1993, pursuant to Indiana Code 13-25-5 (prior to July 1, 1996, IC 13-7-8.9).

The VRP provides a mechanism for site owners, operators or potential purchasers voluntarily to enter an agreement with IDEM to cleanup contaminated property. When the cleanup is successfully completed, IDEM will issue a Certificate of Completion and the Governor's office will issue a Covenant Not to Sue to the cleaned up property. These documents provide assurance that the remediated areas will not become the subject of future IDEM enforcement action.

Implicit in the voluntary nature of the VRP is the recognition that voluntary Parties have a choice to participate or not participate in the VRP. Thus, a voluntary Party can terminate their participation at any point by written notification to the appropriate VRP staff. The voluntary nature of the VRP benefits owners, real estate purchasers, lending institutions and developers. At the same time, the VRP benefits the environment and the public interest by the resulting identification and cleanup of contaminated property.

1.0 ELIGIBILITY

Any site owner or operator, or a prospective owner or operator, who wishes to clean up property that has been contaminated with petroleum or hazardous substances is potentially eligible to participate in the Voluntary Remediation Program.

An application may be rejected if:

- 1. A state or federal enforcement action concerning the proposed cleanup is pending; or
- 2. A federal grant compels IDEM to take enforcement action; or
- 3. Conditions at the site are considered to be an imminent and substantial threat to human health or the environment.
- 4. The application is not complete.

Cleanups that have already been completed are potentially eligible for the program. The applicant must submit documentation of the clean up that satisfies the VRP's requirements and assure that current cleanup criteria have been met.

2.0 APPLICATION PROCESS

The first step in the Voluntary Remediation process is to complete and submit an application with a \$1000.00 application fee. If an applicant withdraws from the VRP, the unexpended portion of the application fee will be refunded. The application assumes that a site characterization has already been

completed on the site. Pursuant to Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7), the application will receive confidential treatment. The application itself will not be part of IDEM's public records. Material submitted after the application has been accepted will not be confidential and will be a part of IDEM's public records. Do not submit additional documents with your application. These will be returned.

IDEM has 30 days to make an eligibility decision. An incomplete application is grounds for rejection. Incomplete applications will be returned to the applicant within 45 days of receipt with the missing information identified. Incomplete applications may be resubmitted upon revision.

3.0 VOLUNTARY REMEDIATION AGREEMENT

The Voluntary Remediation Agreement is a standard document that identifies the obligations of both the applicant and IDEM. Parties seeking assistance under the VRP are expected to cooperate and adhere to certain standards in the investigation of the extent and nature of contamination, the evaluation and recommendation of remedial actions and the level of cleanup attained. In addition, the applicant agrees to reimburse IDEM for the costs that it incurs in reviewing work plans and reports, and for oversight of the cleanup itself. IDEM will provide the applicant with an estimate of review and oversight costs within the Agreement. The Agreement also establishes deadlines for the completion of milestone tasks, and the schedule for payments by the applicant to IDEM. Once the Agreement is signed, the applicant prepares and submits a series of work plans and reports for IDEM's review. These include:

- 1. A Phase II Investigation Report.
- 2. A Remediation Work Plan
- 3. A Remediation Completion Report

The <u>Voluntary Remediation Program: Resource Guide</u> contains the requirements and guidance for all of these documents.

4.0 PUBLIC PARTICIPATION

Public involvement is an essential component of the VRP. The Remediation Work Plan is subject to a 30-day public notice and comment period. During the public notice period, IDEM will place a copy of the Remediation Work Plan in a local repository and invite interested Parties to comment. IDEM may hold a public hearing if at least one request is received during the public comment period. Applicants are encouraged to contact any affected Parties, community groups and local officials regarding their voluntary cleanup as soon as possible.

5.0 IMPLEMENTATION

Upon approval of the Remediation Work Plan, remediation work may begin. The site owner or operator must notify IDEM within 60 days of approval that he or she intends to proceed with implementation of the plan.

Implementation oversight of the Remediation Work Plan is accomplished through a combination of written progress reports and IDEM field oversight. A schedule for progress reporting and operational inspections is required in the Remediation Work Plan.

6.0 CLEANUP CRITERIA

Cleanup criteria for sites within the Voluntary Remediation Program consists of a combination of performance and quantitative standards. The performance standards apply to all cleanups. Quantitative standards are based on a three tiered approach which includes background levels, generic risk based standards and site specific risk based standards.

7.0 PROJECT COMPLETION

When the remediation is completed, the applicant will submit a Remediation Completion Report. The Completion Report contains results of sampling to confirm that cleanup criteria have been met as well as other information necessary to demonstrate that the Remediation Work Plan has been successfully completed. IDEM will split all confirmatory sampling with the Applicant. Once the voluntary cleanup has been successfully completed and payments to IDEM have been made for oversight costs, IDEM's Commissioner will issue a Certificate of Completion and the Governor's office will issue a Covenant Not to Sue. The Voluntary Remediation process is then complete.

8.0 ADVANTAGES OF PARTICIPATING IN THE PROGRAM

The Certificate of Completion and Covenant Not to Sue provide both the applicant and future land owners with an assurance that the voluntary cleanup has been performed properly and their future liability is strictly limited. This assurance is important to prospective purchasers of the property, and prospective lenders where property is being offered as collateral. Participation in the Voluntary Remediation Program will facilitate the sale and reuse of industrial and commercial properties in the State, an important benefit to all Indiana residents.

Although the Voluntary Remediation process has controls to ensure that cleanups result in a level of protection no less stringent than regulated or enforced cleanups, the process provides both IDEM and participants with greater flexibility in developing remedial solutions. Participants who are accepted in the Voluntary Remediation Program work cooperatively with IDEM which minimizes their transactional costs.

In order to facilitate cleanups, the Voluntary Remediation statute waives state and local permit requirements associated with the construction of remediation technologies or other aspects of a cleanup if it is pursued under the Voluntary Remediation Program. Federal permits, such as RCRA, NPDES, and Air permits cannot be waived.

RESOURCE GUIDE JULY 1996 Confidential Voluntary Remediation IDEM Internal 30 Day Rejected If Application Application And \$1,000.00 Fee Approval Period Deemed Incomplete Received Approved If Application Deemed Incomplete, Voluntary Remediation Agreement Sent To **IDEM Provides** Applicant With Cost Estimate Applicant List Of Deficiencies Within 45 Days Applicant Signs Voluntary Remediation Agreement And Sends It Back To IDEM **IDEM Signs Voluntary Remediation Agreement** IDEM Internal Applicant Submits Remediation WorkPlan 60 Day Review Period IDEM Has 30 Days To Send Applicant 30 Day Remediation Workplan Approval Letter **Public Comment** Period Applicant Sends Notice To IDEM To Implement Workplan Within 60 Days Of Approval Letter Remediation Implemented, IDEM Oversight & Completion Sampling **Applicant Submits Remediation Remediation Completion** Completion Report Report Accepted By IDEM IDEM Commissioner Issues Certificate Of State Of Indiana Governor's Office Issues Completion Covenant Not To Sue

Indiana Department of Environmental Management

Voluntary Remediation Program Application and Instructions

How Will the Information I submit be Used?

The information provided on the Application will be used to determine an Applicant's eligibility for participation in the Voluntary Remediation Program. It also serves as an initial summary of conditions at the site. The Application assumes that a Phase I Environmental Site Assessment or similar investigation has already been performed.

Application Fee

Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7) establishes a \$1,000.00 application fee which must be submitted along with the completed Application Form. IDEM cannot process the Application until the fee is submitted.

Where Should I Send My Application?

Remove the Application Form by tearing along the perforation. Send the completed form along with the application fee to:

Indiana Department of Environmental Management Attn.: Cashiers Office Voluntary Remediation Program 100 N. Senate Ave.-IGCN P.O. Box 7060 Indianapolis, Indiana 46206-7060

Send an additional copy of the Application Form to:

Indiana Department of Environmental Management
Office of Environmental Response
Voluntary Remediation Program
100 N. Senate Ave
P.O. Box 6015
Indianapolis, Indiana 46206-6015

How Long Will it Take to Process My Application?

IDEM has 30 days to make an eligibility determination on an application. An incomplete application is grounds for rejection. Incomplete applications will be returned to the Applicant within 45 days of reciept, with the missing information identified. Incomplete applications may be resubmitted upon revision.

INSTRUCTIONS

FOR THE

CONFIDENTIAL VOLUNTARY REMEDIATION PROGRAM APPLICATION (PAGE ONE)

Headers - At the top of each following page, indicate the Facility Name to ensure that separated pages will be properly filed with their respective facility.

<u>Facility ID Number</u> - Leave blank, assigned by the Department of Environmental Management <u>EPA ID Number</u> - Enter the ten character alphanumeric code for facilities which have an EPA Identification number. If the facility does not have such a number, enter N/A.

A. General Information - Indicate the level of oversight requested, site activities and site status by filling in the oval next to the appropriate answer. Be sure to include operational dates and location information as requested on the form.

<u>Site Investigation</u>- Indicate status of any site investigation as related to contaminant and/or area to be voluntarily remediated at time of application. Check Formal Workplan Review Requested if you want IDEM to comment on a site investigation plan prior to implementation. Please note: IDEM, by statute, cannot formally approve a site investigation workplan.

<u>Site Remediation</u> - Indicate status of any site remediation as related to contaminant and/or area to be voluntarily remediated at time of application.

<u>Current Site Status</u> - Indicate current site operational status. Self explanatory.

<u>Years of Operation</u> - If known, enter the beginning and ending years (or beginning only if current operations are on-going), e.g. 1932 / 1995, of site operation. Check Unknown if years of operation are unknown.

<u>UTM Coordinates and Township, Range, and Section</u> - Indicate proper UTM Coordinates and Township, Range, and Section numbers.

B. Property Ownership - Indicate both facility owner and operator information

<u>Applicant</u> - Indicate the name, mailing address, city, state, zip code, and telephone number of the applicant. Indicate the two character Alpha FIPS code for the state of the applicant e.g., IN - Indiana, NY - New York, etc. The applicant is the person or group who is guiding the remedial activities at the site and will be issued the Covenant Not to Sue upon completion of remediation activities.

Operator of Facility - Complete this section if the operator of the facility is different from the applicant. Indicate the two character Alpha FIPS code for the state of the facility operator, e.g., IN - Indiana, NY - New York, etc.. Use this section only if the facility is still operated by the person or group who will be conducting the voluntary remediation.

C. Facility Location & Description - Indicate facility and contact person information along with any unusual site hazards and Standard Industrial Classification associated with the facility's current operations.

<u>Facility Location</u> - If the facility name or location is different than the applicant or operator mailing address, indicate this in the space provided. Enter the street address where the facility is located. If the precise street address is unavailable, enter a brief direction identifier, e.g., NW jct I-295 & US99. If the facility is currently owned by someone other than those conducting the voluntary remediation, please identify the facility name as it occured under ownership or direction of the applicant, e.g., the former XYZ facility. Please be sure to include the county where the facility is located.

<u>Contact Person</u> - Identify the contact person for remedial activities at the site. Indicate the two character Alpha FIPS code for the state of the contact person , e.g., IN - Indiana, NY - New York, etc.. **All correspondence and information from IDEM will be sent to the person identified.**

<u>Brief Description</u> - Mark the oval(s) to indicate the hazards posed by the facility or contaminant(s) at the site. If the facility or contaminant(s) poses no unusual hazard, mark None.

<u>Standard Industrial Classification</u> - Please mark the oval(s) that apply to the operation(s) that currently occur at the facility. If the facility is currently inactive, indicate the most current operation identification. Refer to the general Standard Industrial Code (SIC) classifications when describing the type of operation.

PROPERTYOWNERSHIP

FACILITY LOCATION & DESCRIPTION

INSTRUCTIONS

FOR THE

CONFIDENTIAL VOLUNTARY REMEDIATION PROGRAM APPLICATION (PAGETWO)

D. Contaminant Information- Page 2 and 3 (if needed) - Each column of the Contaminant Information is dedicated to **One Contaminant Category**. Only include information on contaminants that are to be included in the Voluntary Remediation Program.

Storage - Mark the oval(s) to indicate how the contaminant to be remediated is stored at the facility . Physical State - Mark the oval(s) that describes the physical state of the contaminant to be remediated. Gross Amounts - Indicate the type and units of measure of storage for the contaminant to be remediated. Please indicate a numeric value associated with the appropriate unit(s) of measure in the space provided under the appropriate general contaminant catagory.

<u>Maximum Levels & Units</u> - Fill in the appropriate spaces to show the maximum levels detected during contaminant(s) sampling. Refer only to contaminant(s) targeted for voluntary remediation.

Media Targeted for Clean Up - Mark the oval(s) to show what media has been impacted by the contaminant(s) targeted for voluntary remediation.

<u>Constituents</u> - Use this space to identify the specific individual chemical, as described in the contaminant category information, that is to be voluntarily remediated. Please identify all constituents to be remediated. The Covenant Not To Sue will be specific to the identified chemical constituents. To ensure that all potential contaminates are included in the Covenant Not To Sue when it is issued, include any potential breakdown constituents in this space.

E. Permits/ Enforcement Information- Answer the questions by marking the appropriate boxes, and if applicable, further explain any environmental permits and/or enforcement action taken at the facility.

<u>Permits</u>- Please identify any environmental permits issued to the facility. If federal, state, local or other types of environmental permits have been issued, specify the type, permit number, date issued and expiration date. <u>Enforcement</u>- Mark the appropriate box to indicate any past or current enforcement actions at the facility. Provide a narrative description of any enforcement action against the facility if applicable. One of the conditions which *may* (but not necessarily) cause a Voluntary Remediation Program Application to be rejected is a pending enforcement action which addresses the subject of the proposed cleanup.

F. Water Information-

<u>Local Drinking Water Supply</u>- Indicate the *closest* source(s) of local drinking water within the vicinity of the facility. This must include, at a minimum, all adjoining properties and local communities. Indicate either municipal or private/residential water supplies. Identified drinking water supply(s) must be listed under the Water Quality Usage Descriptions. Also identify the distance of the *closest* drinking water source from the facility.

<u>Local Surface Water Bodies</u>- Indicate the type of surface water bodies that may be in the vicinity of the facility. Identified surface water supply(s) must be listed under the Water Quality Usage Descriptions. Also identity the distance of these bodies from the facility.

<u>Local Surface Water Use</u>- Indicate if any surface water body(s) is used, affected and/or potentially affected by the contaminates targeted for voluntary cleanup at the facility. Mark the appropriate oval(s). <u>Local Groundwater Use</u> - Indicate if groundwater is used, affected, and/or potentially affected by the contaminates targeted for voluntary cleanup at the facility. Mark the appropriate oval(s).

<u>Site Specific Depth To Groundwater</u> - Use information already gathered from previous site investigation(s). If unknown mark appropriate oval.

<u>Site Specific Groundwater Flow Direction</u> - Use information already gathered from previous site investigation(s). If you marked Unknown for Site Specific Depth To Groundwater, then do not mark an oval. <u>Water Quality</u> - Usage Descriptions- Use this space to detail all identified water bodies and water supplies along with additional information you wish to provide.

INSTRUCTIONS

FOR THE

CONFIDENTIAL VOLUNTARY REMEDIATION PROGRAM APPLICATION (PAGE THREE)

G. Chronological Summary and Conclusions - Provide the following information in as much detail as space allows. Use all headings. A lack of a response will jeopardize the application's completeness.

<u>Facility Operational History</u> - Indicate past operational activities associated with the facility. If known, please identify all past companies, years of operation and type of operations for the past 25 years. <u>Past Spill History</u> - Identify all past spill incidents associated with the facility that relate to the contaminant(s) targeted for voluntary cleanup. Please include dates and IDEM incident numbers assigned to the spill and cleanup status. If the facility has no spill history, mark the oval and *do not* write in the spaces provided.

<u>Soil Information</u> - Indicate from previous site specific investigation(s) basic soil information. To include, but not limited to, the following items: site soil stratigraphy, lithologic descriptions or USDA soil textures, Munsell soil color, sedimentary contacts, etc.

<u>Hydrogeological Information</u> - Indicate from previous site specific investigation(s) basic hydrogeological information, including, but not limited to, the following items: depth to groundwater, flow direction, hydraulic conductivity, transmissivity, storativity, confined or un-confined conditions, porosity, average linear velocity, etc.

Off-Site Migration & Pathways - Identify all known and potential off-site contaminant migration and preferential migration pathways (utility lines, sand seams, etc.). If no off-site impacts are known, mark the oval and *do not* write in the spaces provided.

<u>Projected Cleanup Objectives</u>- Mark the oval that describes the potential cleanup objectives for the facility. Answers are non-binding and can be altered at a later date. If the cleanup objectives are unknown at this time, please mark the appropriate oval.

H. Miscellaneous Environmental Information - Please mark the boxes that identify informational resources that were used to assist in completing this application. Include report titles and dates. Indicate if an imminent or substantial threat resulting from the contaminates described in the application is present. Give explanation if needed, and proceed with steps to mitigate the threat.

MISCELLANEOUS

CERTIFICATION

- **I. Statement Of Certification -** Before signing the application, please read the highlighted box. All applications must be signed and dated in ink. No signature photocopies will be accepted.
- **J. Appendices Information -** The application will not be considered complete unless the information asked for in the appendices is provided.

Appendix A: Site Map - Map(s) must include, but are not limited to, the following: illustrated legends and compass directions and at an appropriate scale; identified above ground features (buildings, roadways, property lines, etc.); horizontal and vertical plume identification; geologic cross sections showing the watertable and vertical plume identification; groundwater flow direction; sample locations along with concentrations, etc.. If previous site investigations have not been completed, then please indicate that in the space provided.

<u>Appendix B: Legal Description</u> - Please include the legal description of the facility. Include the facility street address, township, range, section, direction lines, distances, etc..

Appendix C: Miscellaneous - Include other information about the facility, if needed.

State	State Form 47271 (8-95) CONFIDENTIAL Approved by State Board of Accounts, 1995						
Voluntary Remediation Program Application							
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	P.O. Box 6015 Indianapolis, Indiana 46206-6015 (317) 308 - 3106		EPA ID Number				
	suant to Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7), your applicatio application nor any information which comes from the application will be made availation of eligibility, will be	able to the public	c. However, any material				
(A)	SITE INVESTIGATION (CHECK ALL THAT APPLY):	SITE REM	EDIATION (CHECK A	ALL THAT APPLY):			
	○ None○ Ongoing○ Complete○ Formal Workplan Review Requested		○ None ○ Ongoing ○ Complete				
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	UTM COORDINATES AND TOWNSHIP, RANGE, AND SECTION:		Degilling Feat	Lifully real			
В	VOLUNTARY CLEANUP APPLICANT		OPERATO	OR OF FACILITY			
SHIP	APPLICANT NAME	OPERATOR	NAME (If Same As Applica	ant, Mark Oval Here ()			
PROPERTY OWNERSHIP	MAILING ADDRESS	MAILING A	DDRESS				
STY O							
OPEF	CITY STATE	CITY		STATE			
A L	ZIP CODE	ZIP CODE		TELEPHONE —			
C	FACILITY LOCATION CONTACT PERSON						
NO	FACILITY NAME (If Same As Applicant, Mark Oval Here)	ORGANIZAT	TION (If Same As Applicant,	Mark Oval Here ()			
ESCRIPTION	MAILING ADDRESS (If Same As Applicant, Mark Oval Here)		CONTACT PERSON (All Correspondence Will Be Sent To Person Identified)				
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	○ Radioactivity ○ Explosive Condition	one	Other:	ious Material Present			
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	STANDARD INDUSTRIAL CLASSIFICATION (Select of	only one)	_	Official State Use Only			
	 Metal Mining Coal Mining 						
 Paper & Allied Products Petroleum & Coal Products Primary Metal Industries Electronic Equipment 							
O Pipelines (Excluding Natural Gas) O Oil & Gas Production Auto Dealers & Service Stations O Auto Repair, Services & Parking							
	○ Wholesale Trade Nondurable Goods ○ Ru	ubber & Plasti	c Products				
	O Wholesale Trade Durable Goods Tr	ansportation	Equipment				

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CATAGORY (Check only one					
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Gaseous				\circ
Slurry				
Other:	0	0	0	0
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CONSTITUENTS	·		!	
(Please specify individual	chemical(s) targete	d for voluntary c	leanup per each '	Waste Catagory identified above
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STATE I	FACIL	71(8-95) LITY NAME	CON	FIDENTIAL			
E			PERMITS/ENFORC	EMENT INFORM	ATION		
	Does Your Facility Have Now Or Ever Had A RCRA Permit Or RCRA Interim Status? ☐☐ No ☐☐ Yes						
		TYPE OF PERMIT	PERMITNUMBER	PERMITNUMBER DATE ISSUEI		TION DATE	
IENT							
ORCEN]
PERMITS/ENFORCEMENT	Are You Required To Investigate Or Remediate This Facility By Any Other Permit Condition, Commissioner's Order Or Condition Of Any Other Rule?						
PERMIT	Has	Your Facility Had Any Pa (If S	So, Please Provide A				
F			WATER IN	IFORMATION			
	LOC	AL DRINKING WATER S	SURFACE	WELL		DISTANCE FROM	
		icipal ate/Residential	()	()	() F () M		
	LOC	AL SURFACE WATER BO	ODIES		SURFACE WATE	R DISTANCE FRO	M SITE
	V	Vetland(s) Stream	River Lake	Pond ()	() F		
	LOC	AL SURFACE WATER US	E(Check all that apply)	LOCAL	GROUNDWATER	R USE(Check all that a	(vlage
NOI	USE	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		USED AFFECTE		(11 37
RMAT		O O Irrigation			Drinking \$	rceDrinking Water Source W/ Others	
WATER INFORMATION		Comme Not Cu	ercial Irrently Used			ial, Industrial rently Used	
NATEI	D	SITE SPECIFIC EPTH TO GROUNDWATI	rn I		OUNDWATER FLO		\sim
_	(Unkn)					West
	WAT	ER QUALITY USAGE DES	CRIPTIONS				

	FACILITY NAME
G	CHRONOLOGICAL SUMMARY AND CONCLUSIONS
	Please Provide The Following Information In As Much Detail as Space Allows. Limit The Information To The "Highlights" And Maintain A Chronological Format.
	FACILITY OPERATIONAL HISTORY:
	PAST SPILL HISTORY: (If No Incidents Have Occurred, Then Mark Oval Here)
	PAST SFILL HISTORY. Who induction have occurred, main oral rice of
	SOIL INFORMATION:
	HYDROGEOLOGICAL INFORMATION:
	OFF-SITE MIGRATION & PATHWAYS: (If Not Impacted, Then Mark Oval Here)
	PROJECTED CLEANUP OBJECTIVES: OTIER II TIER II TIER III
	RESIDENTIAL NONRESIDENTIAL

	FORM 47271(8-95) FACILITY NAME
(H)	MISCELLANEOUS ENVIRONMENTAL INFORMATION
	INFORMATION RESOURCE(S) (Check All That Apply) C PREVIOUS SITE STUDY: (Include Title & Date)
	C OTHER: (Include Title & Date)
	U.S GEOLOGICAL SURVEY STATE REPORTS SOIL CONSERVATION SERVICE SITE SPECIFIC DATA REGULATORY REPORTING OTHER GOVERNMENT AGENCIES
	Do The Conditions Regarding Hazardous Substances Or Petroleum, As Described In This Confidential Application, Constitute An Imminent Or Substantial Threat To Human Health Or The Environment? () No () Yes (If Yes, Please Explain Below)
	STATEMENT OF CERTIFICATION
	Pursuant to Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7), your application to the Voluntary Remediation Program (VRP) will receive confidential treatment. Neither the application nor any information which comes from the application will be made available to the public. However, any material submitted to or generated by the VRP after your notification of eligibility, will be considered IDEM public record.
	I,, Do Hereby Attest And Cerfify That The (Print Or TypeName) Information Included Herein Is, To The Best Of MyKnowledge And Belief, Accurate And Complete.
	 Signature Date
\Box	APPENDICES INFORMATION
(J)	This Voluntary Application will not be considered complete unless the following Appendices are included:
	APPENDIX A. SITE MAP
	APPENDIX B. LEGAL DESCRIPTION
	APPENDIX C. MISCELLANEOUS (IF NEEDED)
	`

PHASE II INVESTIGATION REPORT

At the request of the VRP participant, IDEM may informally review a Phase II Investigation Work Plan. Please submit one (1) copy to IDEM to facilitate work plan review. If a Phase II Investigation Work Plan was prepared before site investigation work began, then the purpose of the Phase II Investigation Report is to present site investigation findings. Voluntary Remediation Program participants who elect not to submit a Phase II Investigation Work Plan must document the objectives, rationale and procedures which were followed during the site investigation in the Phase II Investigation Report, as well as presenting site investigation findings. Please submit two (2) copies to IDEM for complete review.

1.0 Introduction

The Introduction section of the Phase II Investigation Report must identify the site's name and address, include a brief description of site operations, and a brief description of the site's history, including a discussion of the events which led up to the site investigation. A site location map and site layout drawing must also be provided. A U.S. Geological Survey map excerpt may be used as a site location map. The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; and any surface water bodies or water wells on or bordering the property.

1.1 SITE BACKGROUND

1.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.
- C. Site map depicting property lines, building outlines, underground utility lines, raw materials and bulk storage, tanks, roads, loading/unloading areas, on-site waste storage, treatment, disposal areas, surface water bodies, and water supply wells.
- D. Brief summary of site history.
- E. Overview of the initial discovery of contamination and/or previous investigations.
- F. Summary of results of Phase II Investigations.
- G. Map depicting facilities and land use within one mile radius (e.g. agricultural, commercial, residential, etc.)

1.1.2 SITE DOCUMENTATION

- A. Identification of previous reports prepared for the site.
- B. Description of available data and/or other documentation regarding the site.

2.0 STATEMENT OF WORK

- 2.1 OBJECTIVES OF PHASE II INVESTIGATION (Complete this section only if Phase II Investigation has not been initiated)
 - A. Description of Phase II Investigation area(s)
 - B. Statement of objectives for each Phase II Investigation area.

- 2.2 SITE SAFETY PLAN (Please refer to Appendix A, page 47)
 - A. Attached standard IDEM Site Safety Plan.
- 2.3 QUALITY ASSURANCE PROJECT PLAN (QAPP) (Please refer to Appendix B, page 51)
 - A. Attached site-specific QAPP

3.0 SITE CHARACTERIZATION

3.1 BASELINE ASSESSMENT (Please refer to Appendix C, page 85)

3.1.1 ECOLOGICAL ASSESSMENT

Participants must present the results of their assessment of potentially affected environmentally sensitive areas (e.g. wetlands, riparian areas, parks, etc.), and potentially affected aquatic and wildlife populations. Potentially affected environmentally sensitive areas must be identified on a map. Key aquatic and wildlife species must be listed. If any endangered species are present in potentially affected areas, their endangered status must be clearly indicated. Potential exposure routes to sensitive areas and/or populations must be identified, and any observed or potential consequences of exposure discussed. If the Baseline Ecological Assessment doesn't potentially find any affected sensitive areas, that fact must be stated.

- A. Identification of potentially affected endangered species.
- B. Identification of aquatic life present.
- C. Contamination pathways to surface water.
- D. Potential exposures to aquatic life.
- E. Identification of wildlife and vegetation found in the vicinity.
- F. Potential wildlife/vegetation exposure pathways.
- G. Discussion of potential or observed effects of contamination on vegetative or wildlife populations.
- H. Identification of environmentally sensitive areas (e.g., riparian areas, floodplain).
- I. Flow and drainage patterns.
- J. Identification of potential stresses to wetlands and floodplain.
- K. Potential exposure routes to environmentally sensitive areas.
- L. Map depicting the locations of floodplain and wetlands.

3.1.2 BACKGROUND HYDROGEOLOGIC ASSESSMENT

In this section, participants must present the results of their "desktop" evaluation of hydrogeologic conditions at the site. Significant findings resulting from a literature search and/or review of publicly available documents must be presented. If existing site-specific subsurface information is available, for example, from foundation borings or existing on-site monitoring wells, this must be summarized. Depth to bedrock; local lithology; regional aquifers; and the occurrence of significant structural features such as jointing, faulting, or folding are examples of topics which must be addressed by the Baseline Hydrogeological Assessment. If participants elect not to undertake a site-specific hydrogeological investigation based upon existing site-specific data discovered during the Baseline Hydrogeological Assessment, the rationale for this decision must be discussed.

- A. Presentation of geologic information obtained during literature search.
- B. Presentation of geologic information obtained from review of available public documents.

- C. Depth to bedrock and description of lithology.
- D. Identification of regional aquifer(s).
- E. Locations of surface water bodies, floodways and drainage.
- F. Description of structural features such as jointing, faulting, and folding.
- G. Summary of existing site-specific data.
- H. Rationale for not undertaking a site-specific hydrogeologic investigation (if applicable).

3.2 BACKGROUND CONCENTRATIONS (Please refer to Appendix E, Tier I, page 95)

Complete this section only if using Background concentrations as potential cleanup objectives.

Background concentrations are useful as a basis for determining whether or not soil, groundwater or other media has been contaminated. They are also one of the cleanup level options available to Voluntary Remediation Program participants. In the Background Concentration section of the Phase II Investigation Report, participants must identify how site background was established and for which media (soil, groundwater, and/or surface water). The investigative methods used must be identified (e.g. monitoring wells, soil borings, water samples). Sample locations must be shown on a map. Sample results must be presented, and the statistical evaluation method(s) used to arrive at background values described. Tabular presentation of sample results will facilitate review.

- A. List of background investigation analytical methods.
- B. Description of methods used in collecting background data (e.g., soil borings, monitoring wells, existing data or literature).
- C. Background sample location map.
- D. Sampling procedures in accordance with QAPP? (If not, explanation of variations).
- E. Presentation of background data in tabular form (media, parameters, concentrations, depth of sample, date, etc.).
- F. Statistical evaluation of background results, if applicable.

3.3 SAMPLING METHODOLOGY

The Sampling Methodology section of the Phase II Investigation Report must identify the areas of the site which were investigated for potential contamination, and indicate which media (e.g. soil, groundwater, debris, sludge) were sampled and why. Sample locations must be shown on a map, and the rationale for their selection discussed. The investigative methods used (e.g. soil borings, monitoring wells, composite debris samples) must be described. Standard monitoring well construction details must be included if monitoring wells were installed. Sampling equipment used must be described, including how field screening equipment and results were used, if applicable. If sample collection, preservation, equipment decontamination and documentation procedures varied from the standard Quality Assurance Project Plan (QAPP) provided as part of the Program application package, these variations must be identified and explained. Copies of waste disposal manifests (if applicable) and chain-of custody forms must be attached.

3.3.1 SAMPLE MATRICES

A. Description of media sampled (e.g., soil, water, sludge).

3.3.2 SAMPLE LOCATIONS

- A. Map showing sample locations.
- B. Rationale for sample locations.

3.3.3 INVESTIGATION METHODS

- A. Methods of investigation used (e.g., soil borings, monitoring wells)
- B. Description of monitoring well installation (drilling method, well depths, well construction details, development procedures).
- C. Description of soil boring installation (drilling method, depths).

3.3.4 SAMPLE COLLECTION

- A. Description of sampling equipment used.
- B. Sample collection procedures in accordance with QAPP? (If not, explanation of variations.)
- C. Sample depths and identification numbers.
- D. Description of the collection of quality control samples (trip blanks, equipment blanks).
- E. Decontamination procedures in accordance with QAPP? (If not, explanation of variations.)
- F. Sample containers in accordance with QAPP? (If not, explanation of variations.)
- G. Sample preservation procedures in accordance with QAPP? (If not, explanation of variations.)
- H. Description of field screening procedures.
- I. Tabulated results of field screening.
- J. Documentation procedures in accordance with QAPP? (If not, explanation of variations.)
- K. Waste disposal data and manifests, chain-of-custody forms.

3.4 SAMPLE ANALYSIS

The analytical methods, sample containers, and preservation techniques used to collect and characterize each sample must be identified. A table showing this information by media and sample location will facilitate review.

3.4.1 ANALYTICAL METHODS

A. Table summarizing the analytical methods, sample containers, and preservation procedures used for each sample matrix and locations.

3.5 SITE INVESTIGATION RESULTS

Sample analysis results must be presented in tabular form for all analysis parameters, media and sample locations. Parameters found at concentrations above method detection limits must be identified. Parameters found at levels above background concentrations must also be identified. Laboratory analytical reports must be attached. Conclusions regarding the vertical and horizontal extent of contamination in soil, groundwater and other affected media (e.g. sediments, surface water) must be discussed. Contaminated areas must be indicated on a map. The results of the site-specific hydrogeologic investigation must also be presented, including the properties of site soils; hydrogeologic

cross sections; water level measurements; water table elevations and potentiometric maps; groundwater flow direction(s) and velocity. If any temporal fluctuations in water levels were observed, these must be identified, and their effect on groundwater flow discussed.

3.5.1 SAMPLE ANALYSIS RESULTS

- A. Table(s) presenting analysis results for all media and parameters above method detection levels.
- B. Identification of parameters found above background levels.
- C Laboratory analytical reports (attached in an appendix).
- D. Description of the horizontal and vertical extent of contamination in soil (include soil boring logs attached in an appendix).
- E. Description and quantification of groundwater quality in the uppermost aquifer and all significant zones of saturation or permeable zones.
- F. Description of the horizontal and vertical extent in the groundwater of any immiscible or dissolved contaminant plume(s) originating from the site or facility.
- G. Velocity of contaminant movement in the groundwater.
- H. Mapped concentrations of contaminants to show vertical and horizontal extent in the soil and groundwater (e.g., mapped sample locations along with depth and contaminant concentrations).
- I. Description/mapping of contamination in other affected media (e.g., sediments, surface water).

3.5.2 Hydrogeologic Investigation Results

- A. Geologic and hydrogeologic properties of contaminated area (e.g., hydraulic conductivity, porosity, grain-size distribution).
- B. Geologic/hydrogeologic cross-sections.
- C. Water level measurements.
- D. Water table elevations and potentiometric maps.
- E. Groundwater flow direction.
- F. Groundwater flow rate.
- G. Groundwater flow gradient, including how it was calculated.
- H. Temporal fluctuations in water levels and their effect on flow direction.

4.0 PHASE II INVESTIGATION REPORT (Complete this section only if Phase II Investigation has not been completed)

4.1 Statement that a Phase II Investigation Report will be submitted and what will be included.

5.0 PHASE II INVESTIGATION REPORT SCHEDULE (Complete this section only if Phase II Investigation has not been completed)

5.1 Proposed schedule indicating expected milestones for completion of the Phase II Investigation Work Plan

6.0 CONCLUSION

Participants must conclude the Phase II Investigation Report with an overall assessment of the extent of contamination on and off-site to include geologic/hydrogeologic illustrations that adequately describe subsurface and contaminant plume identification (e.g., cross-sections, fence diagrams, geophysical profiles, etc.). An initial assessment of the potential risks associated with the contamination must also be presented. If remediation is planned, preliminary remediation alternatives must be identified to the extent possible. A tentative schedule for the submission of a Remediation Work Plan must be given.

- 6.1 Summary of the extent of contamination.
- 6.2 Summary of potential risks associated with the site.
- 6.3 Description of preliminary remediation alternatives and plan to submit Remediation Work Plan, if appropriate.

VOLUNTARY REMEDIATION AGREEMENT

INTRODUCTION

The statute which establishes the Voluntary Remediation Program (VRP), IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9), provides that "Before the department evaluates a proposed voluntary remediation work plan, the applicant who submitted the work plan and the Commissioner must enter into a voluntary remediation agreement that sets forth the terms and conditions of the evaluation and the implementation of the work plan." The agreement must contain provisions which address the following:

(The applicable sections are in parentheses.)

- 1. A requirement that the department provide an itemized list of costs that the department estimates it will incur in providing oversight for the remediation. (Section XX, paragraph 51)
- 2. The recovery of all reasonable costs incurred by the department which exceed the application fee. (Section XX)
- 3. A schedule for the payment of those costs. (Section XX)
- 4. Dispute resolution. (Section XVI)
- 5. Indemnification. (Section XXII)
- 6. Retention of records. (Section XV)
- 7. A timetable for the review and approval or disapproval of the work plan by the department. (Section VII)
- 8. Interagency coordination. (Section X)
- 9. Any other provisions deemed necessary by the Commissioner or the applicant.

Other provisions which have been deemed necessary by the department are:

- 1. Section IX, COMPLIANCE WITH APPLICABLE LAWS: This section requires the Applicant to comply with all state, federal and local laws and regulations.
- 2. Section XII, QUALITY ASSURANCE: This section requires the Applicant to follow certain procedures when collecting and analyzing samples to ensure that the data is reliable.
- 3. Section XIX, RESERVATION OF RIGHTS: This section reserves certain rights for the department, such as the right to terminate the agreement if the site poses an imminent and substantial threat to the human health and the environment.
- 4. Section XXV, TERMINATION AND SATISFACTION: This section provides that the Governor shall give the Applicant a covenant not to sue upon the successful completion of the remediation as set out in the work plan.

Other provisions which may be included in the Voluntary Remediation Agreement as the agency deems appropriate are:

1. LEAKING UNDERGROUND STORAGE TANKS: This section will be inserted where appropriate and deals with the Department's obligations under various federal grants in the Underground Storage Tank section. It also states that Applicants will be eligible for reimbursement under the Indiana Underground Petroleum Storage Tank Excess Liability Fund under certain conditions.

2. NATURAL RESOURCE DAMAGES: Either the agency or the Applicant can propose that the Work Plan address natural resource damages. If both Parties agree to address the damages, then Applicant must expressly agree that all costs for any pre-assessment screen will be reimbursed.

3. INVESTIGATION WORK PLAN and REMEDY SELECTION: This language will be used where an Applicant has not done a complete investigation or wishes to have IDEM oversight of its investigation. Both of these sections should be used in either instance. Neither should be used alone.

VOLUNTARY REMEDIATION AGREEMENT Relating to (Site)

Company)
, Indiana)
)
Company)
Applicant)
)
Voluntary Remediation of:)
(site))
IDEM Site #)
)
Proceeding under)
the Environmental)
Management Act)
(Indiana Code 13-25-5))

(prior to July 1, 1996, IC 13-7-8.9)

I. INTRODUCTION

1. The Indiana Department of Environmental Management ("IDEM"), by its Commissioner ("Commissioner"), and ______ ("Applicant") hereby enter into this Voluntary Remediation Agreement ("Agreement"), pursuant to IC 13-25-5-8 (prior to July 1, 1996, IC 13-7-8.9-13) for the purpose of remediating the release of hazardous substances or petroleum at (site, city, county) Indiana.

II. JURISDICTION

- 2. This Agreement is entered into by and between applicant and the IDEM, by its Commissioner, pursuant to IC 13-25-5-8 (prior to July 1, 1996, IC 13-7-8.9-13), hereafter collectively referred to as the "Parties."
- 3. The Parties agree to the following terms and conditions for the evaluation and implementation of the Voluntary Remediation Work Plan (Work Plan) and to waive their rights to administrative and judicial review of the binding effect and enforceability of the Agreement and agree not to contest the jurisdiction of IDEM to enter into this Agreement. However, the Applicant reserves all rights it may have under common law, the Indiana Code and federal statutes to seek contribution or indemnity from others not signatories to this Agreement.
 - 4. By entering into this Agreement, the Applicant neither admits nor denies liability.

III. STATEMENT OF ELIGIBILITY

5. The Commissioner has determined that the application submitted by Applicant is complete and that Applicant is eligible to participate in the voluntary remediation program established under IC 13-25-

5 (prior to July 1, 1996, IC 13-7-8.9). However, neither the Commissioner's determination of eligibility nor the entry into this Agreement precludes any finding by the Commissioner at a later date that the site poses an imminent and substantial threat to human health or the environment within the meaning of IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9). In addition, if it is determined that Applicant withheld or misrepresented information that would be relevant to the Applicant's eligibility, the Commissioner may withdraw from this Agreement.

(The following language will be used when an application is submitted for the remediation of a leaking underground storage tank (LUST).)

The Commissioner has determined that this site is appropriate for acceptance into the voluntary remediation program, subject to the reservation of rights contained in Section XVIII. In addition, if at any time, the Commissioner determines that an enforcement action is required at this site under the provisions of certain federal grants provided to the IDEM, the approval of the Work Plan may be withdrawn and this Agreement terminated, pursuant to IC 13-25-5-5(a)(2) (prior to July 1, 1996, IC 13-7-8.9-10(a)(2)). If it is determined that Applicant is eligible for the Indiana Underground Petroleum Storage Tank Excess Liability Fund pursuant to IC 13-23-1 (prior to July 1, 1996, IC 13-7-20) and all applicable rules, Applicant may apply for reimbursement from this Fund of the costs of the remediation required by this Agreement. However, Applicant expressly waives the right to claim reimbursement for costs paid to IDEM as Administrative Costs, as described in Section XX and for the application fee as provided in IC 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7).

Applicant shall comply with all applicable state and federal requirements for corrective action. For purposes of determining compliance with applicable state and federal requirements for corrective action and for determining eligibility for the Indiana Underground Petroleum Storage Tank Excess Liability Fund, approval of a previously submitted corrective action plan shall constitute approval of the Voluntary Remediation Work Plan.

IV. PARTIES BOUND

- 6. This Agreement shall apply to and be binding upon the Applicant, its officers, directors, principals, employees, agents, successors, subsidiaries and assigns and upon IDEM, its employees, agents and successors. The signatories to this Agreement certify that they are fully authorized to execute and legally bind the Parties they represent. No change in ownership, corporate, or partnership status of the Applicant shall in any way alter its status or responsibilities under this Agreement unless Applicant or IDEM withdraws from this Program.
- 7. The Applicant shall provide a copy of this Agreement to any subsequent owners or successors before ownership rights are transferred. The Applicant shall provide a copy of this Agreement to all contractors, sub-contractors, laboratories, and consultants which are retained to conduct any work performed under this Agreement, within fourteen (14) days after the effective date of this Agreement or within fourteen (14) days of the date of retaining their services.

V. DEFINITIONS

- 8. "Day" or "calendar day" shall be defined as the 24-hour period between 12:00 A.M. 12:00 A.M..
- 9. "Site" shall be used in the manner as defined by IC 13-11-2-203(a) (prior to July 1, 1996, IC 13-7-8.9-6); which includes the legal description of the site located at (address), (city), (county), Indiana.
- 10. All other terms contained in this Agreement shall be used in the manner as defined by IC 13-11-2 (prior to July 1, 1996, IC 13-7-8.9).

VI. STATEMENT OF PURPOSE

- 11. This Agreement sets forth the terms and conditions of evaluation and implementation of a Voluntary Remediation Work Plan proposed by the Applicant for the remediation of the release or threatened release of petroleum or hazardous substances from the site.
- 12. The activities conducted by the Applicant under this Agreement are subject to approval by IDEM. Applicant shall provide all necessary information for a Work Plan for the site. The activities conducted by the Applicant shall be consistent with this Agreement, all applicable laws and regulations and any appropriate guidance documents. Applicant shall employ sound scientific, engineering and construction practices.

VII. WORK TO BE PERFORMED

13. All work to be performed by the Applicant pursuant to this Agreement shall be under the direction and supervision of a Certified Professional Engineer or Certified Professional Geologist or other qualified persons with expertise in hazardous substance or petroleum site investigation and remediation. This individual may or may not be designated by Applicant as Applicant's Project Manager pursuant to Paragraph 24. Prior to the initiation of site work, the Applicant shall notify IDEM, in writing, regarding the name, title, and qualification of such engineer or geologist and of any contractors and/or subcontractors to be used in carrying out the terms of this Agreement. Selection of any such engineer or geologist or contractor and/or subcontractor shall be subject to disapproval by IDEM.

This language will be used when there has not been sufficient investigation done on the site to fully determine the nature and extent of the contamination and such an investigation is necessary before the Applicant can make a recommendation as to the remedy.

The Applicant shall submit a complete Investigation Work Plan for the investigation of the nature and extent of the contamination at the site and the feasibility study to IDEM. The Investigation Work Plan shall be developed in accordance with any pertinent guidance documents provided by IDEM.

The Investigation Work Plan submittal shall include, but not be limited to, the following project plans; (1) a quality assurance project plan; (2) a sampling and analysis plan; (3) a health and safety plan; (4) a community relations plan; (5) a schedule for implementation of all tasks set forth in the

Investigation Work Plan; and (6) data management plan.

The IDEM may require Applicant to submit additional or corrected information pursuant to IC 13-25-5-9 (b) (prior to July 1, 1996, IC 13-7-8.9-14(b)).

The Investigation Work Plan shall be subject to review and evaluation by IDEM for any other provisions provided for in IC 13-25-5-9 (prior to July 1, 1996, IC 13-7-8.9-14). The IDEM Project Manager shall review and evaluate the Investigation Work Plan within sixty (60) calendar days of receipt. The Investigation Work Plan shall be deemed incorporated into and made an enforceable part of this Agreement.

- 14. Applicant shall submit a Voluntary Remediation Work Plan which contains a recommendation as to the remedial actions Applicant intends to perform at the site. The remedial actions shall be selected using any U.S.EPA or IDEM guidance documents selected by IDEM as appropriate.
- 15. The Voluntary Remediation Work Plan submittal shall include, (1) a detailed description of the investigation conducted by the Applicant in preparing the Voluntary Remediation Work Plan and a description of the work to be preformed by the Applicant to determine the nature and extent of the actual or threatened release, (2) a proposed statement of work to accomplish the remediation in accordance with guidelines established by the department; and (3) the following project plans; (a) a quality assurance project plan; (b) a sampling and analysis plan; (c) a health and safety plan; (d) a community relations plan; (e) a schedule for implementation of all tasks set forth in the Voluntary Remediation Work Plan; and (f) data management plan.
- 16. The IDEM may request Applicant to submit additional or corrected information pursuant to IC 13-25-5-9 (b) (prior to July 1, 1996, IC 13-7-8.9-14(b)). The Applicant may comply with the request or withdraw the proposed plan from consideration.
- 17. The Voluntary Remediation Work Plan shall be subject to review and evaluation by IDEM pursuant to IC 13-25-5-9(a) (prior to July 1, 1996, IC 13-7-8.9-14(a)) within sixty (60) days of receipt of the Work Plan. Additionally, the department may request the applicant to supply additional information or corrected information pursuant to IC 13-25-5-9(b) (prior to July 1, 1996, IC 13-7-8.9-14(b)). This time period shall not include the time required for public comment under IC 13-25-5-11 (prior to July 1, 1996, IC 13-7-8.9-15(b)).
- 18. The Commissioner shall make a determination concerning the approval, modification and approval, or rejection of the Voluntary Remediation Work Plan within thirty (30) calendar days of close of the public comment period provided for in IC 13-25-5-11 (prior to July 1, 1996, IC 13-7-8.9-15(b)) and notify the Applicant as provided in IC 13-25-5-12 (prior to July 1, 1996, IC 13-7-8.9-15(c)) or 13-25-5-13 (prior to July 1, 1996, IC 13-7-8.9-15(d)).
- 19. If the Applicant desires to proceed with the implementation of the approved Work Plan, the Applicant must notify the Commissioner in writing not more than 60 days after the Work Plan is approved. After providing such notice, the Applicant shall initiate the work detailed in the Voluntary Remediation Work Plan according to the schedule as set forth in the Commissioner's Notice of Approval.

Upon the Commissioner's receipt of notice that the Applicant intends to proceed, the fully approved Voluntary Remediation Work Plan shall be deemed incorporated into and made an enforceable part of this Agreement.

VIII. ADDRESSES FOR ALL CORRESPONDENCE

20. Documents, including reports, approvals, notifications, disapprovals, and other correspondence, to be submitted under this Agreement, may be sent by certified mail, return receipt requested, hand delivery, overnight mail or by courier service to the following addresses or to such addresses as the Applicant or IDEM may designate in writing.

Documents to be submitted to IDEM should be sent to:

M_. _____ Voluntary Cleanup Project Manager P.O. Box 6015 Indianapolis, Indiana 46206-6015 (317) 308 - ___

Documents to be submitted to the Applicant should be sent to:

(Applicant supplied information)

IX. COMPLIANCE WITH APPLICABLE LAWS

- 21. All work undertaken by the Applicant pursuant to this Agreement shall be performed in compliance with all applicable Federal, state and local laws, ordinances and regulations, including, but not limited to, all Occupational Safety and Health Administration, Department of Transportation and Resource Conservation and Recovery Act regulations. In the event of a conflict in the application of Federal, state, or local laws, ordinances and regulations, the Applicant shall comply with the more/most stringent such laws, ordinances, or regulations, unless provided otherwise in writing by IDEM. As provided by IC 13-25-4-26 (prior to July 1, 1996, IC 13-7-8.7-14), no state or local permit shall be required for any portion of the work conducted entirely on-site. However, where it is determined that such a permit is required under federal law, Applicant shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals. The Applicant shall be responsible for obtaining all Federal permits which are necessary for the performance of any work hereunder.
- 22. Nothing in this Agreement or in IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9) relieves Applicant of its obligations or responsibilities under the Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq., including the duty to meet any permit conditions including, but not limited to, financial responsibility, closure, post-closure or corrective action. The Covenant Not to Sue shall not be construed to relieve applicant of any duty to perform closure, post-closure or corrective action regardless of whether the Work Plan addressed the contaminants or property at issue.

X. INTERAGENCY COORDINATION

- 23. The following agencies may have an interest in the Work Plan because of coexisting or contiguous natural resources or concurrent jurisdiction over the site:
 - 1. Indiana Department of Natural Resources
 - 2. Indiana State Department of Health
 - 3. Fire Prevention and Building Safety Commission

Applicant shall provide notice to these agencies of the submission of the Work Plan. Any of the above named agencies that wish to review the Work Plan shall be given an opportunity by the Commissioner to comment during the time IDEM is reviewing the Plan. The Commissioner shall consider any comments from state agencies that are received at least thirty (30) days prior to the deadline established in this Agreement for approval or rejection of the Work Plan.

(The following language will be inserted into the Voluntary Remediation Agreement when appropriate for Natural Resources Damages)

Respondent shall notify the Indiana and Federal Natural Resources Trustees of this Action within 30 days of the effective date of this Agreement. This section shall not release Applicant or any person from liability to the federal government for claims of natural resource damages under any federal law.

The Natural Resources Trustees shall perform the pre-assessment screen for injury to, destruction of, or loss of natural resources. The Applicant expressly agrees to reimburse IDEM for any and all costs incurred by either IDEM or the Department of Natural Resources in performing the pre-assessment screen. The Applicant will perform the assessment of damages based on the pre-assessment screen.

A Certificate of Completion and Covenant Not to Sue issued under Section XXV shall release Applicant from liability for claims for natural resources damages if Applicant devises and carries out a plan for restoration, rehabilitation, replacement or acquisition of equivalent natural resources or pays to the State the value of the natural resources, as determined by the Trustees. The plan shall be developed and implemented as part of the Remediation Work Plan.

XI. DESIGNATED PROJECT MANAGER

24. On or before the effective date of this Agreement, IDEM and the Applicant shall each designate a Project Manager. Each Project Manager shall be responsible for overseeing the implementation of this Agreement. The IDEM Project Manager will be the IDEM designated representative at the site. To the maximum extent possible, communications between the Applicant and IDEM and all documents (including reports, approvals, and other correspondence) concerning the activities performed pursuant to the terms and conditions of this Agreement shall be directed through the Project Managers. During implementation of this Agreement, the Project Managers shall, whenever possible, operate by consensus and shall attempt in good faith to resolve disputes informally through discussion of the issues. Each Party has the right to change its respective Project Manager by notifying the other Party in writing at least five (5) calendar days prior to the change.

25. The IDEM Project Manager shall have the authority to halt, conduct, or direct any work required by this Agreement and/or any response actions or portions thereof when conditions may present an imminent and substantial threat to human health or the environment. In the event that the IDEM Project Manager halts work pursuant to this paragraph, the schedule of work described in the Work Plan and this Agreement shall be modified accordingly or the IDEM may withdraw its approval of the Work Plan pursuant to Section XVIII.

26. The absence of the Applicant's or IDEM's Project Manager from the site shall not be cause for the stoppage of work. The Applicant's Project Manager or his supervisor shall reasonably be available by telephone while the field investigation is being performed. The Applicant's Project Manager shall designate a person to be in charge who will be available on-site when field work is being performed.

XII. QUALITY ASSURANCE

- 27. The Applicant shall use quality assurance, quality control, and chain of custody procedures in accordance with the Quality Assurance Project Plan approved for use by IDEM, throughout any Work Plan sample collection and analysis activities under this Agreement, unless IDEM agrees otherwise.
- 28. Applicant shall provide the IDEM Project Manager with reasonable advance notice of all sampling and analysis as detailed in the Work Plan. To provide quality assurance and maintain quality control, the Applicant shall:
 - (a) allow IDEM personnel and/or IDEM authorized representatives reasonable access to laboratories and personnel utilized by the Applicant for analyses;
 - (b) ensure that all sampling and analyses are performed according to U.S. EPA methods, the approved Quality Assurance Project Plan, or other methods deemed satisfactory by IDEM; and,
 - (c) ensure that any laboratories used by the Applicant for analyses participate in a documented Quality Assurance/Quality Control program that complies with U.S. EPA guidance documents. As part of such a program, and upon request by IDEM, such laboratories shall perform analyses of samples provided by IDEM to demonstrate the quality of analytical data for each such laboratory.
- 29. In the event any laboratory fails to perform the activities required above, IDEM reserves the right to reject any data not gathered pursuant to the requirements listed above, and to require that the Applicant utilize a different laboratory.

XIII. SAMPLING AND DATA/DOCUMENT AVAILABILITY

- 30. The Applicant shall, upon request, make the results of all sampling, including raw data, and/or tests or other data generated by the Applicant, or on the Applicant's behalf, available to IDEM. IDEM will make available to the Applicant the quality assured results of sampling and/or tests or other data similarly generated by IDEM.
- 31. At the request of IDEM, the Applicant shall provide split or duplicate samples to IDEM and/or its authorized representative, of any samples collected by the Applicant pursuant to the implementation of this Agreement. At the request of the Applicant, IDEM or its authorized representative, shall provide

split or duplicate samples to the Applicant of any samples collected by IDEM and/or its authorized representative pursuant to the implementation of this Agreement. Each Party shall notify the other in advance of any sample collection activity.

XIV. ACCESS

- 32. To the extent that the site or other areas where work is to be performed hereunder is presently owned or controlled by Parties other than those bound by this Agreement, the Applicant shall obtain, or shall use its best efforts to obtain access agreements from the present owners. Best efforts shall include at a minimum, a certified letter from Applicant to the present owner of such property requesting access agreements to permit Applicant, IDEM and their authorized representatives access to such property. Any such access agreements shall be incorporated by reference into this Agreement. Such agreements shall provide access for IDEM and authorized representatives of IDEM, as specified below. In the event that such access agreements are not obtained, the Applicant shall so notify IDEM, which may then, at its discretion, assist the Applicant in gaining access. IDEM reserves the right to withdraw or modify, as necessary, this Agreement, should the Applicant's inability to gain access to the site or other areas materially affect the Applicant's ability to perform the work required herein.
- 33. The Applicant shall provide authorized representatives of IDEM access to the site and other areas where work is to be performed at all reasonable times. Such access shall be related solely to the work being performed on the Site and shall include, but not be limited to: inspecting records, operating logs and contracts related to the site; reviewing the progress of the Applicant in carrying out the terms of this Agreement; conducting such tests, inspections, and sampling as IDEM may deem necessary; using a camera, sound recording, or other documentary type equipment for field activities; and, verifying the data submitted to IDEM by the Applicant hereunder. The Applicant shall permit IDEM's authorized representatives to inspect and copy all records, files, photographs, documents, and other writings, including all sampling and monitoring data, which pertain to this Agreement and over which the Applicant exercises control. All persons with access to the site pursuant to this Agreement shall comply with approved health and safety plans.
- 34. Nothing herein shall be construed as restricting the inspection or access authority of IDEM under any law or regulation.

XV. RECORD PRESERVATION

- 35. The Applicant agrees to preserve, during the pendency of this Agreement and for a minimum of six (6) years after its termination, all records and documents in the Applicant's possession or in the possession of its employees, agents, accountants, contractors, which relate in any way to the subject matters covered by this Agreement. Upon request by IDEM, the Applicant shall make available to IDEM such records, or copies of any such records. After this six year period, the Applicant shall notify IDEM in writing thirty (30) calendar days prior to the destruction of any such documents. At that time, if IDEM requests that some or all documents be preserved for a longer period of time, the Applicant shall provide IDEM with the documents that IDEM wishes to preserve.
 - 36. Applicant may assert a confidentiality claim, pursuant to applicable laws and rules IC 13-14-11-

1 thru IC 13-14-11-5 (prior to July 1, 1996, IC 13-7-6-6 and IC 13-7-16-3), and 5-14-3) with respect to any or all of the information requested or submitted pursuant to this Agreement. Any assertion of confidentiality shall be adequately substantiated by Applicant when the assertion is made. Information determined to be confidential by the IDEM shall be disclosed only to the extent permitted by IC 13-14-11-1 (prior to July 1, 1996, IC 13-7-6-6) and IC 5-14-3. If no such confidentiality claim accompanies the information when it is submitted to the IDEM, it may be made available to the public by the IDEM without further notice to the Applicant. Applicant agrees not to assert any confidentiality claim with regard to any physical or analytical data.

XVI. DISPUTE RESOLUTION

- 37. This section (Dispute Resolution) shall apply to any dispute arising under any section of this Agreement, unless specifically excepted.
- 38. The Parties shall use their best efforts to, in good faith, resolve all disputes or differences of opinion informally. If, however, disputes arise concerning this Agreement which the Parties are unable to resolve informally, the Applicant may present written notice of such dispute to IDEM and set forth specific points of dispute and the position of the Applicant. This written notice shall be submitted no later than five (5) calendar days after the Applicant discovers the Project Managers are unable to resolve the dispute. The Applicant's Project Manager will notify IDEM's Project Manager immediately by phone or other appropriate method of communication, prior to written notice, when s/he believes the Parties are unable to resolve a dispute.
- 39. Within ten (10) calendar days of receipt of such a written notice, IDEM shall provide a written response to the Applicant setting forth its position and the basis therefore. During the five (5) calendar days following the receipt of the response, the Parties shall attempt to negotiate in good faith a resolution of their differences.
- 40. (a) Following the expiration of the time periods described in the immediately preceding paragraph, if IDEM concurs with the position of the Applicant, the Applicant shall be notified in writing and this Agreement shall be modified to include any necessary extensions of time or variances of work. If IDEM does not concur with the position of the Applicant, IDEM, through the Commissioner or his/her designate, shall make a determination regarding the dispute, based upon and consistent with the terms of this Agreement, and shall provide written determination of such resolution to the Applicant.
 - (b) In the event that such determination is not acceptable to either Party, the dispute may be submitted to an impartial third Party for mediation in the following manner:
- (1) The Parties shall select a mediator from the Indiana Supreme Court's approved list of mediators as established by the Indiana Rules of Alternative Dispute Resolution (ADR Rules) within five (5) calendar days of Applicant's receipt of the Commissioner's determination. In the event such a list does not exist or does not contain mediators which the Parties agree are qualified to mediate environmental disputes, the Parties shall use a mutually acceptable list and select a mediator within five (5) calendar days of compilation of such other mutually acceptable list. In addition to the qualifications required by the ADR Rules, the mediator shall have experience in environmental issues.

(2) The dispute shall be initially submitted to the mediator via a written request for dispute resolution through mediation; the written request shall be issued within 10 days after notification of the Parties of IDEM's final determination of the dispute, as provided by paragraph 40(a) of this section. The request for assistance shall include the written determination of the Commissioner issued pursuant to paragraph 40(a) and the documents specified in paragraphs 38 and 39 of this section. A copy of the written request shall be delivered to the other Parties at the time the request is made.

- (3) The Party which submitted the dispute to mediation may make a written submission in support of its position to the mediator, if the mediator so requests, within 10 days of the mediator's selection, and any other Party may make a written response in support of its position within 7 days thereafter. The mediator shall immediately thereafter contact all Parties and determine the course of the mediation, including scheduling any meetings deemed necessary.
- (4) The mediation process shall be conducted in accordance with Indiana Rules of Alternative Dispute Resolution in any aspect not covered by this Agreement.
 - (5) The mediator and the Parties shall proceed with all due speed to resolve the dispute.
- (6) All communications, whether oral or written, between the mediator and the Parties, shall be kept confidential in accordance with the Indiana Rules for Alternative Dispute Resolution, Rule 2.12.
- 41. If either Party determines or the mediator declares that the dispute cannot be resolved through the mediation process, the Parties retain all rights under the Indiana Administrative Orders and Procedures Act, IC 4-21.5.
- 42. Until the dispute is resolved, any actions concerning that element of work in dispute shall be halted. The resolution of the dispute shall be incorporated into the Work Plan and made an enforceable part thereof. The time schedule for the work in dispute shall be extended by the amount of time needed for resolution. Elements of work and/or obligations not affected by the dispute shall be completed in accordance with the schedule contained in the Work Plan.
- 43. Elements of work and any actions required as a result of such dispute resolution shall immediately be incorporated, if necessary, into the appropriate plan or procedure, and into this Agreement. The Applicant shall proceed with all remaining work according to the modified plan or procedure.

XVII. FORCE MAJEURE

44. The Applicant shall cause all work or required reporting to be performed within the time limits set forth herein, unless performance is delayed by events which constitute a force majeure. For purposes of this Agreement, a force majeure is an event arising from circumstances beyond the reasonable control of the Applicant which delays performance of any obligations required by this Agreement. Increases of costs shall not be considered an event of force majeure.

45. The Applicant shall notify IDEM by calling within three (3) calendar days and by writing no later than seven (7) calendar days after any event which the Applicant contends is a force majeure. Such notification shall describe the anticipated length of the delay, the cause or causes of the delay, the measures taken or to be taken by the Applicant to minimize the delay, and the timetable by which these measures will be implemented. The Applicant shall have the burden of demonstrating that the event is a force majeure. The decision of whether an event is a force majeure shall be made by the Assistant Commissioner, or his/her designate, of the Office of Environmental Response. Said decision shall be immediately communicated to Applicant.

46. If a delay is attributable to a force majeure, the time period for performance under this Agreement shall be extended, in writing, by the amount of time that is attributable to the event constituting the force majeure.

XVIII. RESERVATION OF RIGHTS

- 47. IDEM and Applicant reserve all rights and defenses they may have pursuant to any available legal authority unless expressly waived herein.
- 48. Nothing herein is intended to release, discharge, or in any way affect any claims, causes of action or demands in law or equity which the Parties may have against any person, firm, partnership or corporation, not a Party to this Agreement for any liability it may have arising out of, or relating in any way to, the generation, storage, treatment, handling, transportation, release or disposal of any materials, hazardous substances, hazardous waste, contaminants, or pollutants at, to, or from the site. The Parties to this Agreement expressly reserve all rights, claims, demands, and causes of action they have against any and all other persons and entities who are not Parties to this Agreement, and as to each other for matters not covered hereby.
- 49. The Applicant reserves the right to seek contribution, indemnity, or any other available remedy against any person other than IDEM found to be responsible or liable for contributions, indemnity, or otherwise for any amounts which have been or will be expended by the Applicant in connection with the site.
- 50. The IDEM reserves the right to bring an action, including an administrative action, against Applicant for any violations of statutes or regulations except for the specific violations or releases that are being remediated in the Work Plan.
- 51. Pursuant to IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9), the IDEM reserves the right to withdraw its approval of the Work Plan at any time during the implementation of the Work Plan if:
 - (a) IDEM determines that the Applicant has failed to substantially comply with the terms and conditions of this Agreement or the Work Plan;
 - (b) the Applicant declines to implement the Work Plan after being notified of its approval by the IDEM; or

(c) IDEM determines that a hazardous substance or petroleum has become an imminent or substantial threat to human health or the environment.

Upon withdrawal of its approval, this Agreement shall be terminated and IDEM reserves the right to bring any action to enforce any statute or regulation under Title 13 of the Indiana Code including an action regarding the violations or releases that were the subject of this Agreement.

52. IDEM acknowledges that, pursuant to IC 13-25-5-20(b) (prior to July 1, 1996, IC 13-7-8.9-20(b)), Applicant, upon receipt of the Certificate of Completion, is not liable for claims for contribution concerning matters addressed in the Voluntary Remediation Work Plan.

XIX. ADMINISTRATIVE COSTS

- 53. Applicant agrees to reimburse IDEM for all of its administrative costs associated with implementation of this agreement. Attachment A contains an itemized list of estimated costs that IDEM expects to incur under this Agreement. The estimated costs may include the preparation of the itemized list of administrative costs. This estimate is not intended to bind IDEM to a maximum cost it is entitled to bill the Applicant under this Agreement. The estimate is merely provided as a courtesy to the Applicant.
- 54. IDEM shall send periodically an accounting of contractor, subcontractor and laboratory costs to Applicant. Applicant shall pay said amount within thirty (30) days of receipt of the accounting. IDEM shall also send periodically an accounting of IDEM's staff costs to Applicant. Said accounting shall itemize all costs incurred by IDEM for time, salary, benefits and travel costs of IDEM staff personnel and associated indirect costs. Applicant shall pay said amount within thirty (30) days of receipt of the accounting.
- 55. Checks should be made payable to the Voluntary Remediation Fund and be mailed along with a transmittal letter stating the site name and address to the Indiana Department of Environmental Management; Attention: Cashier; 100 North Senate Avenue; P.O. Box 7060; Indianapolis, Indiana 46207-7060. In addition, a copy of the check and transmittal letter shall be mailed to the IDEM Project Manager.
- 56. Administrative costs shall include all reasonable costs, direct and indirect, of IDEM's oversight arrangement for this Agreement and the Work Plan including, but not limited to, time, salary, benefits and travel costs of IDEM personnel and its contractors and associated indirect costs, contractor costs, compliance monitoring, including the collection and analysis of split or duplicate samples, inspection of Applicant's activities, site visits, discussions regarding disputes that may arise as a result of this Agreement, review and approval or disapproval of reports, and the costs of dispute resolution. Such costs shall also include the costs incurred by IDEM in having a qualified person oversee the conduct of the Applicant under this Agreement and the Work Plan. In addition, Applicant shall be assessed an additional amount not to exceed ten (10) % of the total administrative costs paid to IDEM. This amount will ensure that the IDEM meets its obligations under IC 13-25-5-22 (prior to July 1, 1996, IC 13-7-8.9-22) and all other expenses not covered above. Said amount must be paid before the Certificate of Completion will be issued by the IDEM.

57. In the event that this agreement is terminated for any reason, Applicant agrees to reimburse IDEM for all of its administrative costs reasonably incurred to the time of termination. IDEM agrees to reimburse Applicant any unused portion of the application fee in accordance with IC 13-25-5-8 (b) (2) (prior to July 1, 1996, IC 13-7-8.9-13 (b) (2)).

XX. COMMUNITY RELATIONS

- 58. The Applicant will cooperate with IDEM in providing information about the Work Plan to the public. IDEM will give the Applicant reasonable advance notice of and may require the Applicant's or its agent's attendance at any such public meetings it may hold or sponsor at times and locations which are agreed upon by IDEM and the Applicant.
- 59. A public information file shall be maintained by IDEM at a public repository near the site. Applicant shall be notified of the location of said public place.
- 60. Before the Commissioner may approve or disapprove the Work Plan, the Commissioner shall provide opportunities for public comment pursuant to IC 13-25-5-11 (prior to July 1, 1996, IC 13-7-8.9-15(b)).

XXI. NOTICE OF BANKRUPTCY

61. As soon as Applicant has knowledge of its intention to file bankruptcy or no later than 7 days prior to the actual filing of a voluntary or involuntary bankruptcy petition, Applicant shall notify IDEM of its intention to file a bankruptcy petition.

XXII. <u>INDEMNIFICATION</u>

62. The Applicant agrees to indemnify and save and hold the State of Indiana, its agencies, departments, agents, and employees, harmless from any and all claims or causes of action arising from, or on account of, acts or omissions of the Applicant, its officers, employees, receivers, trustees, agents, or assigns, in carrying out the activities pursuant to this Agreement.

XXIII. EFFECTIVE DATE AND SUBSEQUENT MODIFICATION

- 63. The effective date of this Agreement shall be the date on which this Agreement is signed by the Commissioner of IDEM.
- 64. This Agreement may be amended by mutual agreement of IDEM and the Applicant. Amendments shall be in writing and shall be effective when signed by the Commissioner of IDEM.

XXIV. EXTENSIONS OF TIME PERIODS

65. Any written response shall be deemed timely performed if hand delivered or postmarked by the last day of any time period prescribed herein. Whenever a Party has the right or is required to do some act or make some response within a prescribed period after the service of a notice or other paper on it and

the notice or paper is served upon it by mail, three (3) days shall be added to the prescribed period.

- 66. Whenever any Party is called upon to respond or otherwise act in a certain number of days, and if the final day occurs on a Saturday, Sunday or legal holiday (whether state or national), such time limitation shall automatically extend to the next business day after such Saturday, Sunday or holiday.
 - 67. Any time periods specified in this Agreement may be extended only by agreement of the Parties.

XXV. TERMINATION AND SATISFACTION

- 68. The provisions of this Agreement shall be satisfied when IDEM gives the Applicant written notice in the form of a Certificate of Completion that the Applicant has demonstrated to IDEM's satisfaction that all of the terms of this Agreement have been completed, including the selection and implementation of a remedial action. This notice shall exclude the provisions of Section XV, Record Preservation.
- 69. Nothing in this Agreement shall restrict the State of Indiana from seeking other appropriate relief to protect human health or the environment from pollution or contamination at or from this site not remediated in accordance with this Agreement.
- 70. After IDEM issues the Certificate of Completion, the Governor shall provide Applicant with a Covenant Not to Sue pursuant to IC 13-25-5-18 (prior to July 1, 1996, IC 13-7-8.9-18). The Covenant Not To Sue shall contain a listing of the specific work and contaminants covered.

XXVI. PRECEDENCE OF AGREEMENT

71. In the event that conflict arises among the terms and conditions of this Agreement ,the Statement of Work, or the approved Work Plan, this Agreement shall govern and the terms and conditions hereunder shall determine the Parties' rights and responsibilities.

TECHNICAL RECOMMENDATION: APPROVED FOR LEGALITY AND FORM: By: ___ By: Attorney for IDEM Assistant Commissioner Office of Legal Counsel Office of Environmental Response **IDEM** Date: Date: Attorney for Applicant (type) Applicant (type) By: _____ By: Title: Title: Date: Date: Approved and adopted by the Indiana Department of Environmental Management this ____ day of _______, 19____.

IDEM Commissioner

REMEDIATION WORK PLAN

The primary purpose of the Remediation Work Plan is to provide a basis for IDEM to evaluate the remedy being proposed for a Voluntary Remediation Program site. In addition, the Remediation Work Plan is subject to a 30-day public notice period, and so serves as a vehicle to inform interested Parties of remedial plans for the site. The Remediation Work Plan also establishes the schedule for implementation of remedial activities, which allows IDEM to coordinate oversight activities with the applicant. <u>Please submit four (4) copies to IDEM for complete review.</u>

1.0 EXECUTIVE SUMMARY

To facilitate review of the Remediation Work Plan, applicants must provide an Executive Summary. The Executive Summary must contain brief statements identifying the sources of contamination; potential exposure pathways; potentially exposed human and ecological populations; additional investigation needs, if applicable; proposed cleanup criteria; the proposed remedy or remedies; and implementation milestones (e.g., start date, treatment system start-up, end date).

Brief statements of the following:

- A. Sources of contamination.
- B. Exposure pathways.
- C. Map depicting facilities and land use within one mile radius (e.g. agricultural, commercial, residential, etc.).
- D. Need for additional investigation, if applicable.
- E. Proposed cleanup criteria.
- F. Proposed remedial alternative(s).
- G. Implementation milestones (e.g., start date, treatment system start-up date, end date).

2.0 Introduction

The Introduction must include the site's name and address, a brief description of site operations, and a brief discussion of the site's history, including the events which led to preparation of the Remediation Work Plan. A site location map and site layout drawing must also be included. A U.S. Geological Survey map excerpt may be used as a site location map. The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; and any surface water bodies or water wells on or bordering the property.

The Introduction must also include a summary of Phase II Site Investigation results. The summary must identify and briefly characterize the contaminants of concern (e.g. toxicity, mobility), and their potential sources (e.g. aerial extent, media impacted).

Potentially affected sensitive areas (e.g. wetlands, riparian areas, parks, etc.) and wildlife or aquatic populations must be identified. The summary must also include a brief characterization of site hydrogeology. The vertical and horizontal extent of contamination must be described and shown on a map drawn to the appropriate scale.

2.1 SITE BACKGROUND

2.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.
- C. Site map depicting property lines, building outlines, raw materials and bulk storage, tanks, roads, loading/unloading areas, on-site waste storage, treatment and disposal, surface water bodies, and water supply wells.
- D. Brief summary of the site history and activities leading up to the Work

2.1.2 **SITE DOCUMENTATION**

- A. Identification of previous reports prepared for the site.
- B. Description of available data and/or other documentation regarding the site.

2.2 SUMMARY OF SITE INVESTIGATION ACTIVITIES

2.2.1 SOURCES AND EXTENT OF CONTAMINATION

- A. Discussion of potential sources of contamination identified in Phase II Investigation.
- B. Description of contaminants of concern and their concentration levels found in environmental media at the site.
- C. Contaminant characteristics (e.g., toxicity, solubility, mobility, etc.)
- D. Description of the horizontal and vertical extent of contamination in soil, groundwater, surface water, sediment, and air. If historical data is available, contamination trends must be discussed.
- E. Table(s) presenting analysis results for contaminants of concern.

2.2.2 ECOLOGICAL ASSESSMENT RESULTS

- A. Summary of aquatic life, wildlife, and environmentally sensitive areas.
- B. Summary of the potential ecological risks associated with the site.

2.2.3 BASELINE HYDROGEOLOGIC ASSESSMENT RESULTS

A. Summary of results of baseline hydrogeologic assessment.

3.0 CLEANUP CRITERIA SELECTION

The Voluntary Remediation Program has a three-tiered framework for establishing cleanup levels. "Tier I" cleanup levels are background concentrations in the case of naturally occurring constituents or constituents for which background concentrations have been established through a site-specific background investigation. For constituents with no natural or site-specific background occurrence, Tier I cleanup levels are laboratory detection levels.

"Tier II" cleanup levels are derived from standard equations used in the federal Superfund and Resource Conservation and Recovery Act (RCRA) corrective action programs. "Tier III" cleanup levels are based on a site-specific Risk Assessment performed by the applicant. Different cleanup level options may be

chosen for different contaminants or media at the same site.

Applicants must state the proposed cleanup levels for the voluntary remediation and present the rationale for their selection in the Cleanup Criteria Selection section of the Remediation Work Plan. If calculations are necessary to arrive at the cleanup levels, they must be shown. If Tier III levels are proposed for any contaminants or media, applicants will need to complete the Risk Assessment section of the Plan.

- A. Proposed cleanup criteria for each of the contaminants of concern (identify residential and nonresidential criteria).
- B. Rationale for proposed criteria.

4.0 STATEMENT OF WORK

The Statement of Work must contain a clear statement of remediation objectives. The objectives must address all affected areas, contaminants and media. Applicants must also list the major remediation tasks which will be undertaken.

4.1 OBJECTIVES OF REMEDIAL ACTION

A. Statement of remediation objectives for all affected media, contaminants, and exposure pathways.

4.2 SUMMARY

A. List of the work items that are planned for the remediation of contamination at the site.

4.3 SITE SAFETY PLAN

IDEM must be able to verify that site remediation work will be conducted in a safe manner. A Site Safety Plan indicating the precautions which will be taken during remediation must be furnished as part of the Remediation Work Plan. IDEM recommends that applicants follow the Site Safety Plan guidelines provided in <u>Appendix A</u> (page 47). Remediation work must be conducted in a manner which conforms to the training and other requirements of the Occupational Safety and Health Administration's (OSHA) hazardous waste site worker protection rules in 29 CFR 1910.120 as applicable.

A. Attach a completed Site Safety Plan.

4.4 QUALITY ASSURANCE PROJECT PLAN

IDEM must also be able to verify that additional investigation work, Risk Assessments, confirmatory sampling and other remediation tasks will be conducted in a manner which will ensure reliable analytical results. Applicants must follow the Quality Assurance Project Plan (QAPP) guidelines provided in Appendix B (page 51) to prepare a site-specific QAPP for proposed remediation work. The QAPP guidelines contain recommended quality assurance procedures for sample collection and analysis. Any proposed exceptions to standard QAPP procedures must be discussed in the Remediation Work Plan.

A. Attach a completed Quality Assurance Project Plan.

5.0 RISK ASSESSMENT (IF APPLICABLE, ATTACH TO THE REMEDIATION WORK PLAN)

If the applicant is proposing Tier III cleanup levels for any contaminants, the Remediation Work Plan **must** include a site-specific Risk Assessment Report with proposed cleanup levels that follow the "Risk Assessment Guidance for Superfund," (RAGS). The Risk Assessment must address site-specific human health risks and may also address ecological risks if warranted. The contaminants to be addressed must be clearly identified. The discussion must include a description of data collection and evaluation techniques, including identification of any additional sampling needs.

If Environmental Fate and Transport modeling is planned, the proposed model(s) must be identified. Proposed exposure assumptions must be clearly stated, and must address future, as well as current land uses. The discussion must also include a summary of what is known regarding potentially exposed populations and exposure pathways.

- A. List of parameters to be addressed by Risk Assessment.
- B. Description of proposed Risk Assessment methodologies (e.g., types of modeling).
- C. Identification of potential pathways of exposure.
- D. Identification of exposure assumptions.
- E. Environmental Fate and Transport data development procedures.
- F. Summary table listing parameters and calculated cleanup levels.

6.0 REMEDIATION PLAN

6.1 ADDITIONAL FIELD INVESTIGATION

If additional sampling or other field work beyond that completed during the Phase II Site Investigation is proposed, applicants must describe the additional tasks and indicate why each is necessary.

- A. Identification of any additional field investigations that will be needed to effectively complete the design of the remediation system.
- B. Reason for the additional investigation.
- C. Complete description of the additional investigation.

6.2 REMEDIATION ALTERNATIVES

IDEM is charged with evaluating the proposed remedy for each Voluntary Remediation Program site. Voluntary Cleanup Program applicants must be able to demonstrate that the remedy(s) represent an effective choice for the site. The selected remedy(s) must be identified, and the rationale for selection discussed. A complete description of the selected remedy must be given, including discussion of the proposed extent of remediation, the anticipated volume of contaminated material, proposed treatment systems, transportation distances, and other relevant factors.

6.2.1 EVALUATION OF REMEDIAL ALTERNATIVES

A. Screening of potentially applicable technologies including evaluation of technical feasibility, protectiveness of human health and the environment, cost, the need for treatability testing, ability to achieve proposed cleanup criteria, and community acceptance.

6.2.2 RECOMMENDED REMEDIAL ALTERNATIVE(S)

- A. Identification of selected remedial alternative(s).
- B. Rationale for selection of alternative(s).
- C. Description of selected alternative(s) including extent of remediation, anticipated volume of contaminated material, size of major technologies, process parameters, cleanup time frames, transportation distances, and special considerations.

6.3 REMEDIATION SYSTEM

If more than one remedial alternative will be used to address different areas on-site, applicants must describe how the remediation system as a whole will work. A block flow diagram, conceptual sketch or other device should be used to illustrate the components of the proposed remediation system. Major equipment (e.g. pumps, air strippers, in-situ treatment equipment) must be listed. A site map showing the areas to be remediated, and the proposed locations of major equipment must also be provided.

If a treatability study is planned, the proposed study methodology must be discussed. The discussion must include a clear statement of treatability study objectives; the proposed scale of the study (e.g. bench-scale, pilot-scale); data requirements and proposed data evaluation methods; pilot plant start-up, operation and maintenance (if applicable); and the anticipated date the study report will be submitted.

State and local permits are waived for remediation projects being undertaken in accordance with a Voluntary Remediation Agreement, however, the substantive provisions of the permits must be met. Applicants must identify any federal permits necessary in order to complete the proposed remedial activities in the Remediation Work Plan. Proposed disposal arrangements for wastes generated during remediation must be described. Any approvals, hazardous waste manifests or other necessary documentation must be identified.

6.3.1 PROJECT DESCRIPTION

- A. Site map depicting area(s) to be remediated.
- B. Overall description of the remediation system and planned implementation.
- C. Drawing depicting locations of remediation equipment.

6.3.2 TREATABILITY STUDY/WASTE CHARACTERIZATION (IF APPLICABLE)

- A. Objectives of treatability study or waste characterization to be performed.
- B. Description of remedial technologies to be tested and equipment required.
- C. Methodology of treatability study (e.g., bench-scale or pilot-scale).
- D. Data requirements and analytical methods to be employed.
- E. Installation and start-up procedures for pilot plants.
- F. Pilot plant operation and maintenance.
- G. Proposed data analysis and interpretation procedures.
- H. Proposed application of the technology at full scale and identification of limitations/optimum operating conditions.

- I. Statement of intention to submit a report detailing the results of the treatability study.
- J. Description of the review and evaluation of the treatability study results.

6.3.3 PRELIMINARY DESIGN

- A. Conceptual design illustrating the components of the remediation system (e.g., block flow diagram).
- B. List of major equipment to be installed for the remediation system.

6.3.4 PERMIT REQUIREMENTS/DISPOSAL APPROVAL

- A. Identification of federal permit requirements for the remediation system. Note: State and local permit requirements will be waived.
- B. Waste disposal approvals needed for implementation of the remediation system.

6.4 MONITORING/CONFIRMATION SAMPLING PLAN (Please refer to Appendix D, page 87) Applicants must include a proposed sampling plan for confirming that cleanup levels have been achieved. For example, if the proposed remedy for contaminated soil is excavation and removal, the sampling plan must identify the proposed number and locations of soil samples to be collected following excavation. The proposed analytical methods to be used on the samples must also be identified.

If intermediate monitoring is proposed, for example, in the case of a treatment system, the plan must also address the proposed monitoring frequencies, parameters, locations and analytical methods. The applicant should notify IDEM at least 3 days in advance of project completion sampling. Advanced notice must be given to IDEM before any confirmatory sampling takes place. This will allow IDEM to observe the sampling activity and possibly obtain duplicate samples.

- A. Description of the monitoring/confirmation sampling to be performed.
- B. Frequency of sampling.
- C. Analytical parameters and methods.

6.5 DATA MANAGEMENT

Depending upon the complexity of the proposed remediation project, additional investigation work, treatment system monitoring and/or confirmation sampling may generate a large volume of data. Well-organized, well-presented data contributes significantly to efficient review and oversight of remediation projects. Applicants should consider and describe how they propose to manage and present the data generated during implementation of the Remediation Work Plan. Tabular formats are preferred wherever possible. The discussion must address the frequency, content and format of progress reports to be submitted to IDEM during implementation of the Plan.

- A. Description of how the monitoring/confirmation sampling data will be documented and reported.
- B. Proposed format of progress reports.

7.0 OPERATION AND MAINTENANCE PLAN (IF APPLICABLE)

If one or more treatment systems are proposed for the site, their operation and maintenance (O&M) must be addressed in the Remediation Work Plan. Applicants should list necessary operation and maintenance tasks, and characterize optimum operating conditions for the system(s). Planned maintenance and replacement events must be identified, and the proposed inspection schedule presented. Potential problems and their proposed remedies should be anticipated. A contingency plan indicating how the applicant plans to respond in the event of a system failure must also be presented.

7.1 NORMAL O&M

7.1.1 SYSTEM OPERATION

- A. List of operation tasks.
- B. List of inspection tasks.
- C. Description of optimum operating conditions.

7.1.2 SYSTEM MAINTENANCE

- A. List of maintenance tasks.
- B. Frequency of maintenance tasks and replacement schedule.
- C. List of maintenance inspection tasks.

7.1.3 INSPECTION SCHEDULE

- A. Schedule for regular operation inspections.
- B. Schedule for regular maintenance inspections.

7.2 POTENTIAL OPERATING PROBLEMS

- A. Description of potential sources of problems or failure of the system.
- B. Description of common remedies of problems or alternatives.

7.3 CONTINGENCY O&M

- A. Description of alternate operation procedures to prevent undue hazard should the system fail.
- B. Notification procedures in the event of system shut-down or failure.
- C. Procedures to follow for system modifications.

8.0 COMMUNITY RELATIONS

The Remediation Work Plan is subject to a 30-day public notice and comment period prior to the Commissioner's decision. If IDEM receives at least one request for a public hearing during this period, a public hearing may also be held, at IDEM's discretion. Applicants may wish to undertake additional public notice activities, such as holding meetings with neighborhood groups or mailing letters to adjacent residents.

If any activities of this kind are planned, the proposed activities must be described, and a tentative schedule outlined. Proposed procedures for gaining off-site access to complete additional investigation work or remediation activities must also be addressed in this section.

8.1 MAILING LISTS

A. Mailing list of affected residents; interested community groups; and local, state, and national officials (e.g., mayor, local newspaper, county health department, representatives, and senators).

B. Name and address of local library that will be the repository for the Remedial Work Plan during the public notice period.

8.2 Public Meetings

- A. Discussion of plans to hold public informational meetings about the proposed remediation process.
- B. Format of meetings.
- C. Proposed public meeting schedule and notification procedures.

8.3 Information Bulletins

- A. Discussion of plans to prepare and distribute information bulletins regarding the remediation system.
- B. Description of the format and types of information included in the bulletins.

8.4 MEDIA USE

- A. Description of the types of media that will be used to inform the general public (newspaper, radio, etc.).
- B. Description of the type of information that will be released to the media.

9.0 COMPLETION OF REMEDIAL ACTION

Applicants must commit to submission of a Remediation Completion Report when all remedial activities are complete and cleanup levels are achieved. This section must also state the expected future use(s) of the site following remediation.

9.1 COMPLETION REPORT

A. Statement that a Completion Report detailing the remediation system and confirmation sampling will be submitted upon completion of the remediation to the cleanup criteria.

9.2 FUTURE USE OF SITE

A. Clear statement of the expected future uses of the site after remediation is completed (e.g., residential or nonresidential).

10.0 SCHEDULE

It is critical that the Remediation Work Plan include a detailed schedule for implementation of the Plan. This will enable IDEM to coordinate implementation oversight activities and the final site inspection with the applicant. The schedule must address all significant remediation milestones (e.g. start date, completion of Risk Assessment and/or treatability studies, equipment ordering, construction start-up, treatment system start-up, etc.), and include a proposed progress reporting schedule. The proposed schedule should either allow sufficient time for review, public notice and approval of the Plan by IDEM before work begins, or be expressed in terms of the anticipated duration of each task, rather than in

calendar terms, so that start-up is contingent upon receiving the approval notice.

A. Full schedule of the remedial activities planned, including investigation items, selection of remedial alternatives, treatability study report, design, equipment specifications, permit application and/or disposal approval submittal, monitoring/confirmation sampling, progress reports, equipment certification, O&M Plan, community relations activities, and the Completion Report.

11.0 COST ESTIMATE

Applicants should include an estimate of total remediation costs. IDEM will use this information to provide estimates of review and oversight costs and to evaluate site progress.

A. Written estimate of current costs of completing the remediation and any monitoring to be performed.

REMEDIATION WORK PLAN FOR SITES WHERE PHASE II INVESTIGATION RESULTS ARE BELOW TIER I OR TIER II LEVELS

The primary purpose of the Remediation Work Plan is to provide a basis for IDEM to evaluate the remedy being proposed for a Voluntary Remediation Program site. In addition, the Remediation Work Plan is subject to a 30-day public notice period, and so serves as a vehicle to inform interested Parties of remedial plans for the site. The Remediation Work Plan also establishes the schedule for implementation of remedial activities, which allows IDEM to coordinate oversight activities with the applicant. <u>Please submit three (3) copies to IDEM for complete review.</u>

1.0 EXECUTIVE SUMMARY

To facilitate review of the Remediation Work Plan, applicants must provide an Executive Summary. The Executive Summary must contain brief statements of the following:

- A. Sources of contamination.
- B. Exposure pathways.
- C. Map depicting facilities and land use within one mile radius (e.g. agricultural, commercial, residential, etc.)
- D. Proposed cleanup criteria.
- E. Proposed remedial alternative(s).

2.0 Introduction

The Introduction must include the site's name and address, a brief description of site operations, and a brief discussion of the site's history, including the events which led to preparation of the Remediation Work Plan. A site location map and site layout drawing must also be included. A U.S. Geological Survey map excerpt may be used as a site location map. The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; and any surface water bodies or water wells on or bordering the property.

The Introduction must also include a summary of Phase II Site Investigation results. The summary must identify and briefly characterize the contaminants of concern (e.g. toxicity, mobility), and their potential sources (e.g., aerial extent and media impacted).

Potentially affected sensitive areas (e.g. wetlands, riparian areas, parks, etc.) and wildlife or aquatic populations must be identified. The summary must also include a brief characterization of site hydrogeology. The vertical and horizontal extent of contamination must be described and shown on a map drawn to the appropriate scale.

2.1 SITE BACKGROUND

2.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.

C. Site map depicting property lines, building outlines, raw materials and bulk storage, tanks, roads, loading/unloading areas, on-site waste storage, treatment and disposal, surface water bodies, and water supply wells.

- D. Brief summary of the site history and activities leading up to the Work
- E. Map depicting facilities and land use within one mile radius (e.g. argicultural, commercial, residential, etc.)

2.1.2 **SITE DOCUMENTATION**

- A. Identification of previous reports prepared for the site.
- B. Description of available data and/or other documentation regarding the site.

2.2 SUMMARY OF SITE INVESTIGATION ACTIVITIES

2.2.1 SOURCES AND EXTENT OF CONTAMINATION

- A. Discussion of potential sources of contamination identified in Phase II Investigation.
- B. Description of contaminants of concern and their concentration levels found in environmental media at the site.
- C. Contaminant characteristics (e.g., toxicity, solubility, mobility, etc.)
- D. Description of the horizontal and vertical extent of contamination in soil, groundwater, surface water, sediment, and air. If historical data is available, contamination trends must be discussed.
- E. Table(s) presenting analysis results for contaminants of concern.

2.2.2 ECOLOGICAL ASSESSMENT RESULTS

- A. Summary of aquatic life, wildlife, and environmentally sensitive areas.
- B. Summary of the potential ecological risks associated with the site.

2.2.3 BASELINE HYDROGEOLOGIC ASSESSMENT RESULTS

A. Summary of results of baseline hydrogeologic assessment.

3.0 CLEANUP CRITERIA SELECTION

The Voluntary Remediation Program has a three-tiered framework for establishing cleanup levels. "Tier I" cleanup levels are background concentrations in the case of naturally occurring constituents or constituents for which background concentrations have been established through a site-specific background investigation. For constituents with no natural or site-specific background occurrence, Tier I cleanup levels are laboratory detection levels."Tier II" cleanup levels are derived from standard equations used in the federal Superfund and Resource Conservation and Recovery Act (RCRA) corrective action programs. "Tier III" cleanup levels would require following the full Remediation Work Plan Guidance.

Applicants must state the proposed cleanup levels for the voluntary remediation and present the rationale for their selection in the Cleanup Criteria Selection section of the Remediation Work Plan. If calculations

are necessary to arrive at the cleanup levels, they must be shown.

A. Proposed cleanup criteria for each of the contaminants of concern (identify residential and nonresidential criteria).

B. Rationale for proposed criteria if different than "Tier II" levels.

4.0 STATEMENT OF WORK

The Statement of Work must contain a clear statement of remediation objectives. The objectives must address all affected areas, contaminants and media.

4.1 OBJECTIVES OF REMEDIAL ACTION

A. Discussion of the rationale of why remedial activities will not be conducted.

5.0 COMMUNITY RELATIONS

The Remediation Work Plan is subject to a 30-day public notice and comment period prior to the Commissioner's decision. If IDEM receives at least one request for a public hearing during this period, a public hearing may also be held, at IDEM's discretion. Site owners and operators may wish to undertake additional public notice activities, such as holding meetings with neighborhood groups or mailing letters to adjacent residents.

If any activities of this kind are planned, the proposed activities must be described, and a tentative schedule outlined. Proposed procedures for gaining off-site access to complete additional investigation work or remediation activities must also be addressed in this section.

5.1 MAILING LISTS

- A. Mailing list of affected residents; interested community groups; and local, state, and national officials (e.g., mayor, local newpaper, county health department, representatives, and senators).
- B. Name and address of local library that will be the repository for the Remedial Work Plan during the public notice period.

5.2 Public Meetings

- A. Discussion of plans to hold public informational meetings about the proposed remediation process.
- B. Format of meetings.
- C. Proposed public meeting schedule and notification procedures.

5.3 Information Bulletins

- A. Discussion of plans to prepare and distribute information bulletins regarding the remediation system.
- B. Description of the format and types of information included in the bulletins.

5.4 MEDIA USE

A. Description of the types of media that will be used to inform the general public (newspaper, radio, etc.).

B. Description of the type of information that will be released to the media.

6.0 FUTURE USE OF SITE

This section must state the expected future use(s) of the site.

A. Clear statement of the expected future uses of the site (e.g., residential, nonresidential, commercial, and recreational).

7.0 COST ESTIMATE

Applicants must include an estimate of total remediation costs. IDEM will use this information to provide estimates of review and oversight costs and to evaluate site progress.

A. Written estimate of site costs.

REMEDIATION COMPLETION REPORT

The primary purpose of the Remediation Completion Report is to document the completion of the activities identified in the approved Remediation Work Plan. The Report also provides important information about the performance of the remediation system, and indicates how the site was restored following remediation. <u>Please submit two (2) copies to IDEM for complete review.</u>

Upon receipt of the Remediation Completion Report, IDEM will schedule a site inspection. If the report and site inspection confirm that remediation is complete, IDEM will issue a Certificate of Completion, and the Governor's Office will issue a Covenant Not to Sue covering the remediated areas and activities.

1.0 Introduction

The Introduction section of the Remediation Completion Report must include the site's name and address, a brief description of site operations, and a brief discussion of the site's history, including the events which led to participation in the Voluntary Cleanup Program. A site location map and site layout drawing must also be included. A U.S. Geological Survey map excerpt may be used as a site location map.

The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; surface water bodies or water wells on or bordering the property; remediated areas; and the location(s) of major remediation equipment.

- A. Brief overview of the purpose of this report and the events leading up to it.
- B. Brief summary of the report contents.

1.1 SITE BACKGROUND

1.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.
- C. Brief description of site history.
- D. Site map(s) depicting property lines, building outlines, raw materials and bulk storage, tanks, roads, loading/unloading areas, work areas, surface water bodies, water supply wells, soil borings, monitoring wells, other sampling locations, and other remediation equipment.

1.1.2 **SITE DOCUMENTATION**

- A. List of previous reports regarding the site.
- B. Description of available data and/or other documentation regarding the site.

2.0 REMEDIAL ACTION

2.1 PROJECT DESCRIPTION SUMMARY

The Remediation Completion Report must include a brief summary of the remediation project. The summary must include a list or brief description of the major remedial activities undertaken; a discussion

of the amounts and disposal arrangements for remediation wastes; and the time required to complete the project.

- A. Summary of remedial activities performed at the site.
- B. Discussion of wastes generated during remedial activities including totals and final disposition.
- C. Description of the time required to achieve the full remediation.

2.2 REMEDIATION SYSTEM DETAILS

Applicants must evaluate the overall performance of the remediation system, noting any significant problems which occurred and how they were addressed. The procedures used to measure and document system performance must be described. The discussion should include a block flow diagram or other conceptual illustration of the system as installed, and a list of the major equipment used or installed. If any equipment was or will be dismantled and/or removed from the site following use, a discussion of decontamination procedures must also be included.

2.2.1 EQUIPMENT USED/INSTALLED

- A. Block flow diagram or description of remediation system as installed.
- B. List of the major equipment used and/or installed for the remediation system.

2.2.2 **DECONTAMINATION PROCEDURES** (if applicable)

- A. Description of the procedures used to decontaminate equipment.
- B. Description of decontamination verification sampling.
- C. Waste disposal.

2.2.3 SYSTEM OPERATION AND DOCUMENTATION

- A. Description of the operation of the remediation system.
- B. Evaluation of overall effectiveness of the system.
- C. Description of the documentation procedures followed in evaluating the system operation.
- D. Discussion of problems encountered during the remediation and how they were addressed.

2.3 CONFIRMATION SAMPLING (Please refer to Appendix D; page 87)

The Remediation Completion Report must include a description of confirmatory sampling procedures as they were actually implemented. The actual number and locations of confirmatory samples must be shown on a map. Sample analysis results must be presented in tabular form, addressing all sampling locations, affected media and contaminants. The name, address and telephone number of the laboratory (or laboratories) which performed the analyses must be identified. Copies of laboratory reports and chain-of-custody forms should be attached as Appendices.

Applicants should explicitly compare confirmatory sampling results with the agreed upon cleanup levels, preferably in tabular format.

2.3.1 DATA COLLECTION AND EVALUATION

- A. Description of confirmatory sample, the collection procedures, and/or other measures used to confirm that cleanup has been completed.
- B. Confirmatory sample location map.
- C. Rationale for sample locations and number of samples.
- D. Description of how confirmatory data was evaluated.
- E. Chain-of-Custody Forms attached.

2.3.2 SAMPLE ANALYSIS RESULTS

- A. Tabulated and/or graphical representation of results (affected media, contaminants, concentrations.)
- B. Laboratory reports attached (in Appendix).
- C. List of analytical methods used and associated parameters.
- D. Name, address, and phone number of laboratory performing the analyses.

2.3.3 COMPARISON OF DATA TO CLEANUP CRITERIA

- A. Table comparing confirmation sample results to cleanup criteria.
- B. Discussion of sample results compared to cleanup criteria, demonstrating that acceptable levels have been attained.

2.4 **SITE RESTORATION** (if applicable)

Site owners and operators must indicate how disturbed areas of the site have been or will be restored following remediation. For example, excavated areas should be backfilled with clean soil and repaved or reseeded as soon as possible.

- A. Description of how the site was restored following remediation activities.
- B. Site map depicting the conditions following remediation and restoration activities.

APPENDIX A: HEALTH AND SAFETY PLAN OUTLINE

GENERIC HASP OUTLINE: To comply with OSHA (29 CFR 1910.120(b)

INDEX

LIST OF ACRONYMS

CHAPTER 1: INTRODUCTION

Defines general applicability and general responsibilities with respect to compliance with health and safety programs.

CHAPTER 2: KEY PERSONNEL/IDENTIFICATION OF HEALTH AND SAFETY OFFICER SITE SUPERVISOR
KEY ORGANIZATIONS
HEALTH AND SAFETY OFFICER
ALTERNATE HEALTH AND SAFETY OFFICER
ORGANIZATIONAL RESPONSIBILITIES

List the personnel and organizations that are critical to the planned activities at the site.

CHAPTER 3: TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS
HISTORICAL REFERENCES
SITE NARRATIVE
RESPONSE ACTIVITY
TASK/CHEMICAL SELECTION
LEVEL OF PROTECTION
CHEMICAL HAZARD TEXT

Simple risk analyses for each site task can be conducted based on the chemical contaminants of concern, the affected media, concentrations, and potential routes of exposure. These elements are essential to any analysis of health risks. OSHA-PELs and IDLH levels should be provided at a minimum for compounds, which have the potential to become airborne.

The HASP also must incorporate some safety risk analyses to address anticipated on-site operations. It should be kept in mind that certain field operations may be less safe when conducted at a hazardous waste site than if conducted in a more conventional environment. Methods and procedures for reducing safety hazards must be provided in the HASP.

CHAPTER 4: PERSONNEL TRAINING REQUIREMENTS

Provides information on the training required for field personnel. This information is consistent with OSHA's 29 CFR 1910.120 regulation covering Hazardous Waste Operations and Emergency Response. The employee's initial health and safety training, annual health and safety refresher training, on-the-job training (where applicable), first-aid training, CPR training, and other training relevant to the performance of hazardous waste site operations must be indicated in the HASP for all individuals

involved in on-site activities.

CHAPTER 5: PERSONAL PROTECTIVE EQUIPMENT TO BE USED

Describes the general requirements of the OSHA designated levels of protection, and the specific levels of protection required for each task at the site. Identify the types of personal protective equipment that will be used for each task.

Engineering controls and work practices should be first explored as methods to protect workers before personal protective equipment is used. The OSHA standard describes PPE ensembles as Level A, B, C, and D. PPE ensembles themselves may create additional hazards such as heat stress under extreme conditions. The HASP will need to include a written PPE program specific to site operations that addresses site hazards, duration of site activity, limitations of PPE during temperature extremes, and PPE selection, use, maintenance and storage, training and proper fitting, donning and doffing procedures, inspection, and in-use monitoring. Depending on what the designated level of protection (determined in Chapter 3) is, you will need to specify the material type to be used for inner gloves, the boots, and the outer garments.

CHAPTER 6: MEDICAL SURVEILLANCE REQUIREMENTS

Defines the medical surveillance programs designed to track the physical condition of employees on a regular basis as well as survey pre-employment or baseline conditions prior to potential exposures. Medical monitoring is required for those personnel who potentially are exposed to hazardous substances in the field and who wear respirators 30 days or more in a year. The program must include initial and periodic medical examinations, examinations upon termination of employment, and medical record keeping.

CHAPTER 7: FREQUENCY AND TYPES OF AIR MONITORING/SAMPLING

Addresses the monitoring that will be performed during site activities. The purpose of air monitoring is to identify and quantify airborne contaminants. Initial screening for identification is often qualitative, using real-time air monitoring equipment. A comprehensive, site-specific air monitoring program must evaluate the exposure potential of all identified and suspected chemical contaminants that could result from all site activities. Typically, such a program consists of two types of air monitoring. First, OSHA has published specific personal exposure monitoring requirements for 23 chemical substances including benzene and formaldehyde. The site-specific air monitoring program must meet any applicable requirements as described therein. The program must characterize representative personal exposures. This is referred to as Personal Air Monitoring.

Second, the program must describe real time air monitoring protocols using direct reading instruments for each site activity as appropriate. These monitoring protocols must describe the frequency and location of all real-time monitoring activity, based upon the nature of the site activity. Periodic real-time monitoring must be performed, at a minimum, whenever site work begins, operations change, work begins on a different portion of the site, any invasive site activity begins, contaminants other than those previously identified are being handled, personnel begin to handle obviously contaminated materials or

personnel are handling leaking drums or containers. Monitoring efforts should focus on personnel most likely to receive the highest exposures and on all personnel likely to be exposed to any substance above the OSHA-Permissible Exposure Limit (OSHA-PEL).

CHAPTER 8: SITE CONTROL MEASURES

A site control program is required by 29 CFR 1910.120(d). It should include a site map, work zones, site communications, safe work practices, individuals qualified to perform CPR and identification of the nearest medical assistance. The "buddy system" should be used throughout site operations.

CHAPTER 9: DECONTAMINATION PLAN

Decontamination involves the safe removal of chemical contaminants from employees and equipment. Decontamination procedures should be chosen to match the anticipated contaminants for the site and be monitored by the site health and safety officer.

CHAPTER 10: EMERGENCY RESPONSE/CONTINGENCY PLAN

Hazardous waste sites can present high hazard environments. Therefore, a program addressing potential emergency situations must be included in the HASP. Such a contingency plan should be communicated to employees on-site through the HASP, as well as through safety meetings and briefings. The emergency response plan portion of the HASP should be sufficiently detailed to insure prompt, safe evacuation of all employees from the site in the event of an emergency. This section will need to address such elements as pre-emergency planning, coordination with local emergency response officials, personnel roles, lines of authority, communication, emergency recognition and prevention, safe distances, site control and security, evacuation routes and procedures, decontamination procedures not covered in other parts of the HASP, emergency medical treatment and first aid, emergency alerting and response procedures, PPE and emergency equipment (e.g., escape packs), site topography, layout, and a method to determine prevailing weather conditions.

CHAPTER 11: CONFINED SPACE ENTRY PROCEDURES

If confined space entries are anticipated during site activities, then confined space entry procedures will need to be detailed in the HASP. Entry into an abandoned building, storage vessel, pit, or any other structure which is not designed for human occupancy and has limited means of entry and exit are examples of confined space entries. OSHA's final confined space entry standard (January 1993) would apply.

CHAPTER 12: SPILL CONTAINMENT PROGRAM

In case of a spill or release of a hazardous chemical on-site, the HASP should contain detailed information in a spill containment program. Though not complete, some of the elements that may need to be addressed in the spill containment program include:

Drum and container storage
Drum and container handling
Opening of drums and containers
Material Handling equipment
Radioactive wastes
Shock sensitive wastes
Laboratory waste packs
Sampling of drum and container contents
Shipping and transport of drums and containers
Spill response procedures

CHAPTER 13: HAZARD COMMUNICATION

Standard to be followed is listed in 29 CFR 1910.1200, Hazard Communication. All employees should be briefed on the hazard communication program and have a written copy for review.

APPENDIX B: QUALITY ASSURANCE PROJECT PLAN (QAPP)

The Voluntary Remediation Program (VRP), was initiated to allow responsible and potentially responsible Parties the opportunity to have a documented record of remediation efforts towards the cleanup of petroleum and hazardous substances that have been released into the environment. To better serve applicants in the program, the Indiana Department of Environmental Management (IDEM), has provided this model Quality Assurance Project Plan (QAPP). The purpose of this document is to set guidelines for meeting the important parameters necessary to produce information that is technically and legally sound.

The following is a model QAPP. In producing a QAPP, we suggest that you follow this format as closely as possible. This model is intended to be usable for the preparation of a QAPP for all types of sites.

It should be noted that some criteria in this model are required for the VRP, if the Covenant Not to Sue is to remain a viable result; others are recommended or suggested. Along with quite a bit of "boiler-plate" language, this model contains site-specific example language from previously approved QAPPs. This example language is intended as a guide to the QAPP writer, to show the level of detail that is typically needed to gain IDEM approval. The portions of the mini-QAPP which are example language are indicated in regular print. During preparation of a site-specific QAPP, these portions should, of course, be deleted and replaced with the pertinent information for your site. Some of the language in this QAPP is applicable to a broad range of sites, and may be considered "boiler-plate". "Boiler-plate" language is indicated by a dark background, such as you see here. The "boiler-plate" language should be of wide-ranging applicability, and has been pre-approved by the Region V Quality Assurance Section. General notes are indicated in **bold print**.

INTRODUCTION

The Indiana Department of Environmental Management (IDEM) requires that all environmental monitoring and measurement efforts participate in a centrally managed quality assurance (QA) program.

Any Party generating data under this program has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and document. To ensure the responsibility is met uniformly, each Party must prepare a written QA Project Plan (QAPP) covering each project it is to perform.

This QAPP presents the organization, objectives, functional activities and specific quality assurance
(QA) and quality control (QC) activities associated with the Remedial Investigation/Feasibility Study
(RI/FS) (or RD/RA, etc.) for the site. This QAPP also describes the specific protocols which will
be followed for sampling, sample handling and storage, chain of custody, and laboratory (and field)
analysis.

All QA/QC procedures will be in accordance with applicable professional technical standards, IDEM requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by ______ in accordance with all IDEM QAPP guidance documents and this model

QAPP. <u>Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005-80)</u>, and the Region V Model QAPP (1991).

On the next few pages is a listing of commonly used terms and acronyms to assure that the terms utilized are common to all Parties using this model.

QUALITY ASSURANCE/QUALITY CONTROL TERMS AND ACRONYMS

The following is an alphabetical list of definitions for terms and acronyms encountered in the QA/QC process or in interactions with organizations performing sampling, laboratory, or regulatory functions. Most, but not all, are referred to in the Guidelines, below. Those not used are included for informational purposes.

ACCURACY The closeness of agreement between an observed value and an accepted

reference value.

ACS American Chemical Society.

APPENDIX VIII RCRA Hazardous Constituents List. 40 CFR 261, Appendix VIII.

APPENDIX IX RCRA Groundwater Monitoring List. 40 CFR 264, Appendix IX.

ARARS Applicable or Relevant and Appropriate Requirements

ASTM American Society for Testing and Materials. Organization which develops and

publishes standard methods of analysis and standards for materials and

procedures. Also refers to standards published by society.

BATCH A group of samples of the same matrix from the same site, not to exceed twenty,

and which are processed as a unit at the laboratory. If the total number of

samples of a particular matrix from a site number more than twenty, each group

of twenty or fewer samples is treated as a separate batch.

BIAS The deviation, due to matrix effects, of the measured value of an analyte from

the "true" value. In the laboratory this is determined from the difference between the measured value of the analyte and the known spiked amount.

BLANK Special "samples" analyzed to determine if all or a portion of an analyte detected

in an environmental sample is the result of external contamination due to handling or other factors in the field or the laboratory, and not actually

representative of site conditions. See EQUIPMENT BLANK, FIELD BLANK,

METHOD BLANK, AND TRIP BLANK.

BNA Base-Neutral-Acid Extractables. (Semi-volatile organic compounds)

CALIBRATION Routine QC procedures performed daily or more frequently to maintain the

accuracy of analytical instruments or measuring equipment by adjusting instrument response to solutions of known concentrations or to know conditions

to the appropriate value; preparation of analytical curve.

to the appropriate variet, proparation of unarytical curve

CALIBRATION Standards prepared by successive dilution of a standard solution working

standards covering the full concentration range required, and expected to be seen in the samples, for the organic or inorganic analytical method. Must be prepared using the same type of acid or solvent used to prepare samples for analysis.

CCC Calibration Check Compound.

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act of

1980, as amended. (Superfund)

CONTINUING Analytical standard run periodically, as specified by method, to verify

CALIBRATION calibration of system.

STANDARD

OBJECTIVES

CLP U.S. EPA's Contract Laboratory Program. Refers to laboratory specifications,

analytical methods, and QA/QC protocols required for Superfund and related

activities.

CRDL Contract Required Detection Limit. Method detection limit required for a given

analyte in a given matrix in the CLP SOW; generally refers to inorganic analysis.

CRQL Contract Required Quantitation Limit. Similar to CRDL but for organic

analysis.

CONTROL A QC sample introduced into a data collection process to monitor

SAMPLE the performance of the system.

DATA QUALITY The quality of data and documentation required to support decisions made in the

various phases of the data collection or clean-up project (e.g., screening,

characterization, risk assessment, and monitoring). They are dependent on the end uses of the data to be collected and are expressed in terms of objectives for

precision, accuracy, bias, and comparability.

DL Detection Limit

DQOs Data Quality Objectives. (See Above.)

DUPLICATE A split sample or an independent second sample taken from the same sample

location for the purpose of documenting precision. See FIELD DUPLICATE,

MATRIX DUPLICATE, and MATRIX SPIKE DUPLICATE.

EQUIPMENT BLANK Also called the Equipment Rinsate. A sample of analyte-free reagent water which has been used to rinse the sampling equipment. It is collected after completion of decontamination and prior to sampling at the next sample location. It is used to document adequate decontamination: to ensure that analytes from one sample location have not contaminated a sample from the next location.

FIELD BLANK Analyte-free reagent water taken to the sampling site, transferred into a sample container on site and then analyzed by the laboratory for the same parameters as the investigative samples. This sample is used to check for procedural

contamination of samples.

FIELD DUPLICATE Independent samples which are collected from the same location or source, as closely as possible to the same point in space and time. They are stored in separate containers and analyzed separately for the purpose of documenting the precision of the sampling process. (Laboratory variability will also be

introduced into the samples' results.)

FSP Field Sampling Plan. Site-specific plan detailing sampling rationale and

protocols and analyses planned per sample type.

HAZARDOUS CONSTITUENT Compound or element designated as a constituent of hazardous waste in the RCRA program and listed in 40 CFR 261, Appendix VIII.

HAZARDOUS SUBSTANCE Compound or element listed in CERCLA Hazardous Substance List, 40 CFR 302.4.

HAZARDOUS WASTE Any solid waste determined to be a hazardous waste, pursuant to 40 CFR 261.3, under RCRA Subtitle C.

HOLDING TIME

Elapsed time, expressed in days, from the date of sampling until the date of

analysis.

INTERFERENCE

An element, compound, or other matrix effect present in a sample which interferes with detection of a target analyte leading to inaccurate concentration

results for the target analyte.

INTERNAL STANDARDS Known compounds of known concentration added to a sample by the laboratory prior to analysis to assist in quantifying the target analytes.

LABORATORY CONTROL A known matrix spiked with compounds representative of the target analytes and used to document SAMPLE laboratory performance.

MATRIX The substrate containing the analyte of interest. Examples are soil, sediment,

sludge, groundwater, surface water, drinking water, and air. Sometimes matrix

types are condensed to soils, waters, and air.

MATRIX DUPLICATE A duplicate field sample used to document the DUPLICATE precision of sampling and homogeneity of a given sample matrix. (Same as field duplicate).

MATRIX SPIKE An aliquot of sample spiked with a known concentration of target analytes for

the purpose of documenting the bias of a method in a particular matrix. The

spiking occurs prior to sample preparation and analysis.

MATRIX SPIKE DUPLICATE A split sample, both portions of which are spiked with identical concentrations of target analytes, for the purpose of determining the bias *and precision* of a method in a particular sample matrix.

MCL Maximum Contaminant Level. Maximum concentration of a contaminant

allowed in drinking water systems by the National Primary Drinking Water regulations: 40 CFR 141.11 (inorganic chemicals) and 141.12 (organic

chemicals).

METHOD BLANK An analyte-free matrix to which all reagents are added in the same volumes or

proportions as used in sample processing. The method blank is carried through the complete sample preparation and analytical procedure and is used to document contamination resulting from the analytical process. (Also called

Reagent Blank or Preparation Blank.)

METHOD DETECTION The minimum concentration of an analyte that can be measured and reported with 99% confidence. It is determined by analysis of a samples with known concentrations at various dilutions. This limit is matrix specific. (i.e.,

soils, vs. waters)

MS/MSD Matrix Spike/Matrix Spike Duplicate. (See above).

ORGANIC-FREE For volatile and semi-volatile analysis. Water REAGENT WATER prepared so

that interferants or contaminants are observed below the method detection limit of the compounds of interest. Methods of preparation include passing tap water through a carbon filter containing about one pound of activated carbon or using a

water purification system to generate organic-free deionized water.

PRECISION The agreement among a set of replicate measurements without consideration of

the "true" or accurate value; variability between measurements of the same

material for the same analyte.

PREPARATION The process used by the lab to prepare a sample for analysis.

PRIORITY List of inorganic and organic analytes commonly tested for

POLLUTANTS in the NPDES (water) program.

PROJECT Single or multiple data collection activities (or remediation activities) that are

related through the same planning sequence.

QA Quality Assurance. (See below.)

QAPP Quality Assurance Project Plan.

QUALITY The management procedures and controls used to ASSURANCE ensure data

quality through the sampling and analysis stages. Sometimes refers to the entire

QA/QC program.

QC Quality Control. (See below.)

QUALITY The day-to-day operational measures used in the CONTROL

CONTROL field during sampling and in the laboratory during analysis to ensure data

quality.

RAS Routine Analytical Services. Analytical procedures used exactly as written in

the CLP SOW and used in the Superfund program.

RCRA The Resource Conservation and Recovery Act of 1976, as amended.

REAGENT BLANK Same as Method Blank. (See above.)

REAGENT GRADE Chemical reagents which conform to the current specifications of the Committee

on Analytical Reagents of the American Chemical Society. Also referred to as

Analytical reagent (AR) grade and ACS reagent grade.

REAGENT WATER For analysis of inorganics. Water that has been generated by any method which

would achieve the performance specifications for ASTM Type II water.

REFERENCE A material containing known quantities of target MATERIAL analytes in

solution or in a homogeneous matrix. Sometimes referred to as a "standard." It

is used to document the bias of the analytical process.

RELATIVE A measurement of precision which compares the measurement

PERCENT of a target analyte, spiked analyte, or surrogate to an identical measurement in a

DIFFERENCE replicate sample. Especially used when sample population is small.

SAP Sampling and Analysis Plan. Site-specific plan detailing sampling rationale and

protocols and analyses planned per sample type.

SAS Special Analytical Services. Used by the CLP to denote non-standard or

specialized analytical protocols, perhaps requiring method development.

SOW Statement of Work. A detailed procedure.

SPIKE A known volume of a solution of target analyte(s) of known concentration added

to a sample before analysis and used to document bias and accuracy in inorganic

analyses. Also called analytical spike.

SPLIT SAMPLES Aliquots of sample taken from the same container and analyzed independently,

usually after mixing or compositing. They are used to document precision.

STANDARD The practice of adding a known amount of an analyte to a sample ADDITION

immediately prior to analysis used to evaluate interferences.

STANDARD A plot of concentrations of known analyte standards versus the instrument

CURVE response to the analyte.

SURROGATE An organic compound which is similar to the target analyte(s) in chemical

> composition and behavior in the analytical process, but which is not normally found in environmental samples. Used to document bias and accuracy in organic

analyses.

SVOA Semi-Volatile Organic Analysis.

SVOC Semi-Volatile Organic Compound. BNA; extractable organic compound.

SW-846 U.S. EPA "Test Methods for Evaluating Solid Waste," 1986 (Third Edition),

plus Updates. Standard methods of analysis, sampling techniques, and QA/QC

procedures.

TAL Target Analyte List. Inorganic elements (metals) and "miscellaneous" analytes

(cyanide, sulfide) included in the CLP SOW ILM02.1 as Routine Analytical

Services.

TCL Target Compound List. Organic compounds (VOCs, SVOCs, PCBs, Pesticides)

included in the CLP SOW OLM01.8 as Routine Analytical Services.

TRIP BLANK A sample of analyte-free media (organic-free reagent water) taken from the

> laboratory to the sampling site and returned to the laboratory unopened and analyzed. It is used to document contamination resulting from migration of

volatile organic compounds during shipping and field handling.

VOA Volatile Organic Analysis Volatile Organic Compound VOC

MODEL QAPP

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1.0 <u>PROJECT DESCRIPTION.</u> The project description should include or reference the following: (A technical person unfamiliar with the project must be able to understand what you have written.)

- Statement of the decision to be made or the question to be answered,
- Description of the site, facility, process, or operating parameters to be studied,
- Anticipated uses of the results,
- A list of all measurements to be performed,
- A project schedule, indicating when samples are expected to be submitted to the laboratory.
- A summary table covering the following for each sampling location:
- Type of sample (air, water, soil, etc.)
- All measurements planned for each sample
- A list of all measurements to be performed, differentiating, where applicable, the critical measurements (those necessary to achieve project objectives), from the non-critical measurements.
- A. A narrative describing site history, operation, and background information, including knowledge of past spills or releases, and regulatory history should be prepared. Past data collections efforts, environmental investigations, or remediation activities should be included. This includes a general description of contamination suspected at the site and a general summary of previous analytical results. A detailed map of the facility and a map of the area in which the facility is located with the facility marked should be included.
- B. Statement of the purpose and scope of the project should be made: the decision to be made, question to be answered, or problem to be solved by the data collection effort, regarding type or level of contamination.
- C. A list of all measurements to be performed should be provided, including a project schedule; indicating when samples are expected to be submitted to the laboratory.
- D. A summary table should be provided for each sampling location. These tables should include: a listing of the total number of samples (including primary samples, and quality control samples) type of sample matrix (air, water, soil, etc.) all analysis planned for each sample differentiating critical measurements, and DQO level. A detailed map must be provided, which clearly identifies each sample location by the unique sample number.
- E. Data Quality Objectives (DQOs) should be identified. What are the anticipated end uses of data generated? (e.g., screening, characterization, risk assessment, etc.) What analysis will accurately and adequately identify the contaminants of concern? Will the analysis selected be able to achieve quantitation limits less than or equal to the target cleanup levels? For these purposes, the following DQO have been developed:

<u>Screening</u> (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to ARARs, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench scale tests). These types of data include those generated on-site through the use of HNu, pH, conductivity, and other real-time monitoring equipment at the site.

<u>Field Analyses (DQO Level 2):</u> This provides rapid results and better quality than in Level 1. This level may include mobile lab generated data depending on the level of quality control exercised.

Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data with quick turnaround used for screening but without full quality control documentation).

<u>Confirmational (DQO Level 4):</u> This provides the highest level of data quality and is used for purposes of risk assessment, evaluation of remedial alternatives and verification that cleanup standards have been met. These analyses require full analytical and data validation procedures in accordance with EPA recognized protocol.

Non-Standard (DQO Level 5): This refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY.

This section should include:

- A. A detailed organizational chart showing management structure and lines of communication to be used for this project.
- B. A brief discussion of project organization and responsibilities.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

Site specific conditions, especially known or suspected releases of contaminants, will determine the exact parameters to be measured at a particular site. This section should include the following:

- A. Summary table and/or discussion of quantitative QA objective
 - i. method of analysis number
 - ii. parameters to be analyzed for
 - iii. practical quantitation limit for each matrix (PQL)
 - iv. precision
 - v. accuracy
 - vi. completeness (as required to meet a specific) statistical level of confidence
- B. Discussion of qualitative QA objective
 - i. representativeness
 - ii. comparability

For purposes of disposal of contaminated media, VRP applicants should also be prepared to perform RCRA characteristic analyses for ignitability, corrosivity, and reactivity and the Toxic Characteristic Leaching Procedure (TCLP).

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, preventive maintenance of field equipment, and corrective action are described in other sections of these Model. The purpose of this section is to state the specific, required QA objectives for accuracy, precision, and representativeness.

A. QA Objectives Defined

1. **Accuracy** is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error. Laboratories assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards," materials of accepted reference value.

Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy can be measured and expressed in terms of the recovery of surrogate compounds (organic analyses) or recovery of spiked compounds (inorganic analyses). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds.

- 2. **Precision** is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e, variability between measurements of the same material for the same analyte. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation.
- 3. **Representativeness** expresses the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and the laboratory quality control protocol.

In developing a sampling rationale (including grid network and sampling points), consideration should be given to past waste disposal practices at the site, knowledge of locations of past releases of contaminants, existing analytical data, and the physical setting and processes. It is recommended that a separate Field Sampling Plan (FSP) or Sampling and Analysis Plan (SAP) be prepared which explains the sampling rationale and sampling methods to be used in detail. The QAPP should refer to the FSP (or SAP) and briefly note the rationale for sampling locations. If no FSP is prepared, the QAPP should provide more detail about both rationale and sampling technique. The proper design of the sampling program; using appropriate sampling, handling, and analytical techniques; and maintaining sufficient QA/QC practices will ensure representativeness of the data to the degree it is possible.

B. Level of Quality Control Effort

It is required that field blanks, trip blanks, field duplicates, and matrix spike samples are analyzed to assess the quality of the data resulting from the field sampling program. It is recommended that laboratory duplicates (investigative samples split by the laboratory *in addition to* MS/MSD samples) are also analyzed. Field and trip blanks, consisting of distilled water, should be submitted to the analytical laboratory with the field samples. Field blanks are analyzed to check for procedural contamination at the site which may cause sample contamination. Trip blanks are used to assess the potential for volatile organic contamination of samples due to contaminant migration during sample shipment and storage. Field duplicate samples are analyzed as a check of sampling and analytical reproducibility; laboratory duplicates provide an estimate of the reproducibility of measurement. Matrix spikes provide information about the effect of the sample matrix on digestion and measurement methodology. All matrix spikes should be performed in duplicate.

C. Level of Effort by the Laboratories.

The following are the *required* minimum QA/QC measures for DQO level 2 data:

- 1. A field blank must be submitted to the laboratory with the investigative samples and analyzed for the same parameters as the investigative samples. The minimum required is one per every ten investigative samples.
- 2. A trip blank must be taken to the site and then analyzed by the laboratory for VOCs for all sites at which VOA is one of the analytical parameters. The trip blank consists of distilled deionized ultra pure water placed in two VOA vials, which are transported to the sampling site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. One trip blank is required for each shipping container.
- 3. Field duplicates must be provided for *each matrix* sampled. The field duplicate will be analyzed for all parameters for which the investigative samples of that matrix are analyzed. The *minimum* number of field duplicates required is one per every ten samples, or *if there are fewer than ten samples per matrix*, one per matrix.
- 4. A matrix spike/matrix spike duplicate sample set must be analyzed, one for every twenty samples or if fewer than twenty samples per matrix, one for *each matrix* sampled. The MS/MSD is an investigative sample which (for each applicable analytical parameter for that sample matrix) is split by the laboratory, spiked with target analytes for that analytical procedure, and analyzed with the other samples of that matrix. Samples chosen as MS/MSD should be selected prior to the sampling event so that sufficient sample volume is acquired; double volume is required for organic analyses.
- 5. The laboratory must run a method (preparation) blank at the beginning of each analytical run. If not all samples are completed in one day, a minimum of one method blank per sample matrix per analytical method must be run at the beginning of each sample batch analyzed each day.
- 6. Upon initiation of an analytical run, the laboratory must perform calibration procedures as instructed by the analytical method(s) used and, where applicable, according to instrument manufacturer specifications. During the length of the run, continuing calibrations must be performed at the frequency specified. Where applicable, calibration blanks must be included in the calibration procedure.

7. Surrogate standards must be added to all samples for organic analysis (VOA, SVOA, Pesticides/PCBs). Surrogate recovery will be used to assess accuracy of organic analyses.

- 8. Accuracy of inorganic analysis will be assessed by the percent recovery of spiked analytes.
- 9. At a minimum, precision will be estimated by calculating the RPD between MS and MSD samples and the RPD between duplicate samples. Statistical evaluation, in lieu of the RPD above, is encouraged if the number of samples per matrix is sufficient and if the VRP applicant opts to obtain a quantity of field duplicates and MS/MSD samples above the minimal requirements.
- 10. Sample chain-of-custody must be maintained and documented as outlined in Section 5.0 of this Model. Copies of the chain-of-custody sheets must be submitted to the IDEM with the data sheets.
- 11. Data, documentation, reports, and other project records must be maintained for a *minimum* of three years after the date of submission of the final report or as required by applicable regulations, whichever is *longer*.
- 12. The control limits used, as outlined in the analytic method, must be maintained. Additional quality control limits or measures specified in the analytical methods used must also be maintained.

D. Control Limits

Control limits are the maximum and/or minimum values defining a range for a specific parameter, as outlined within each analytical procedure, is considered to satisfactorily meet quality control criteria. When the parameter falls outside that range, the procedure is considered to be out-of-control. Whenever the analytical procedure is or becomes out-of-control, corrective action must be taken to bring the analysis back into control. The corrective action must include: (1) finding the cause of the problem, (2) correcting the problem, (3) demonstrating the problem has been corrected by reanalyzing appropriate laboratory reference samples, and (4) repeating the analyses of any investigative samples that may have been affected by the control problem

Exceptions will be made, on a case-specific basis. If the control limit is technically impracticable for a particular sample or analysis, documentation and narrative explanation should be submitted with the data report and raw data. The documentation must include evidence that a good faith effort was made to meet the control limit; this will generally include two attempts to analyze the sample.

4.0 SAMPLING PROCEDURES

A detailed Field Sampling Plan (FSP) should be prepared explaining the sampling rationale, identifying sampling points, and precisely delineating sampling methods and equipment to be used. Alternatively, this detail may be included in the QAPP under Sampling Procedures. The general sampling strategy should aim to document the extent of migration on site, possibility of off-site migration, and concentration levels of contamination. This section of this Model is not intended to provide or mandate detailed sampling procedures or specify equipment to be used; its purpose is to state general requirements and considerations applicable to the VRP. A variety of guidance documents on sampling plans and techniques are available. Table IV-A provides a

partial list of such documents and their sources.

A. QA and Background Samples. As indicated in Section 3.B, above, a field blank and/or trip blank must be provided, a sufficient number of field duplicate samples must be taken, and at least one MS/MSD sample must be designated per matrix. Additionally, a background or upgradient sample must be provided for each matrix sampled. The background samples should be taken from areas that are not impacted by site contamination but that are as close to the site as possible. If background samples must be taken on facility property, they should be taken from uncontaminated areas, or areas least likely to be impacted from releases, at the facility. Consideration should be given to groundwater and surface water flow gradients, as well as to meteorological, geologic, and hydrogeologic factors and the effects of manmade structures in trying to determine unimpacted or least impacted locations.

Four subsurface soil samples will be required to establish background for solid media. For a surface water sample medium, at least one upstream sample is required. For groundwater, a sample from at least one upgradient well is required. Background samples must be tested for all the same parameters for which investigative samples of that medium will be analyzed. The background samples are used to establish naturally occurring concentrations of target analytes and compounds and, therefore, whether or not the concentration of a particular analyte in an investigative sample represents a release. They also help to determine if certain contaminants have migrated from other sources rather than having a source on site.

- B. <u>Sample Volume</u>. Care should be taken that sufficient sample volume is provided for all necessary analyses to be performed. This applies to field blanks, background samples, field duplicates, and MS/MSD samples as well as for investigative samples. This is most easily guaranteed by specifying that samples are collected in specific sizes and types of containers which provide sufficient volume (and meet other necessary criteria) for the particular types of analyses that will be performed. The laboratory conducting the analysis should be consulted for their required sample volume. Samples designated for use as the MS/MSD generally require double volume for organics analysis. For example, if a particular sample matrix is to be submitted for VOA, then the sample designated as the MS/MSD will require *four* 40 ml vials rather than the usual two.
- C. <u>Sample Preservation and Holding Times</u>. It is recommended that all samples are iced to 4EC, but chemical preservatives should only be used for aqueous samples. If an aqueous sample is suspected to be strongly alkaline or acidic, a chemical preservative should not be used. For correct sample preservation and holding times, the method of analysis should be referred to for guidance.
- D. <u>Field Documentation of Sampling and Site Observations</u>. Field records provide the direct evidence and support for the necessary technical interpretations, judgments, and discussions concerning project activities as well as historical evidence for later reviews and analyses. It is important that they are accurate, complete, legible, identifiable, retrievable, and protected against deterioration or loss. Field records generally consist of bound field notebooks with prenumbered pages, sample collection forms, sample location maps, sample analysis request forms, and chain-of-

custody forms. If field analysis or screening is done, they must also include equipment maintenance and calibration forms. Depending on project-specific requirements and organizational protocols, other field records may be kept, such as personnel qualification and training forms and field change request forms. IDEM field records *requirements* are discussed briefly below:

- 1. General. Field records must be written in indelible ink. Exact field documentation protocols are left up to the discretion of the VRP applicant organization or project manager. However, procedures for reviewing, approving, and revising field records must be clearly defined and stated in the FSP, SAP, or QAPP. At a minimum, all documentation errors shall be corrected by drawing a single line through the error so that it remains legible; the error must then by initialed by the responsible individual and the date of the change noted. The correction shall be written adjacent to the error.
- 2. <u>Sample Collection</u>. Sample collection information may be recorded in a bound field notebook with prenumbered pages, on a pre-printed form, or by other means. (Note that if a strict U.S. EPA chain-of-custody protocol will be followed, a bound field notebook is required. The following information must be documented:
 - a. *For sampling event*: the site name and location, date, starting and ending times, weather, names of all people involved in sampling activities, level of personal protection used, documentation of adherence to protocol, any changes made to planned protocol, names of visitors to the site during sampling and reason for their visit, unusual observations, and signature of the person recording the information.
 - b. For each individual sample: a detailed description of location, any measurements made, the unique sample number assigned, the time the sample was taken, physical description of sample, depth from which sample was collected, whether grab or composite (if composite, how composited), equipment used to collect the sample, volume and number of sample containers, how sample is preserved, and signature of sampler. Each field duplicate must be given its own unique sample number; the description should include the unique sample number of its duplicate.

Forms IV-A, IV-B, and IV-C, at the end of this section, are provided as examples of how the mandatory information might be recorded.

- 3. <u>Maps and Drawings</u>. A site map accurately documenting sample collection points and locations of monitoring wells must be included. A vicinity map showing the location of the facility in the community and in relation to nearby population centers and surface water bodies is highly recommended.
- 4. <u>Chain-of-Custody Records</u>. Sample custody will be discussed in detail in Section 5, below. Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include: (1) the project name; (2) signatures of samplers; (3) the sample number, date and time of collection, and whether the sample is grab or

composite; (4) signatures of individuals involved in sample; and (5) if applicable, air bill or other shipping number.

5. Calibration Records & Traceability of Standards/Reagents. If field or mobile laboratory analyses are performed, calibrations must be performed and documented. Calibration is a reproducible reference point to which all sample measurements can be correlated. A sound calibration program shall include provisions for documentation of frequency, conditions, standards, and records reflecting the calibration history of a measurement system. The accuracy of the calibration standards is important because all data will be in reference to the standards used. A program for verifying and documenting the accuracy of all working standards against primary grade standards shall be routinely followed.

TABLE IV-A- IDEM SAMPLING REFERENCES AND SOURCES

SAMPLING (AND RELATED) SOURCES WITH DOCUMENT NUMBERS

SW-846/RCRA General

SW-846, Third Edition, <u>Test Methods for Evaluating Solid Waste</u>, Volume Two, Chapter Nine: "Sampling Plan."

SW-846, Third Edition, <u>Test Methods for Evaluating Solid Waste</u>, Volume Two, Chapter Ten: "Sampling Methods."

CLP/Superfund General

"Sampler's Guide to the Contract Laboratory Program," December, 1990. EPA/540P-90/006

"User's Guide to the Contract Laboratory Program," December, 1988. EPA/9240.0-1 (Call EPA Sample Mgmt. Office at (703) 557-2490.)

"Data Quality Objectives for Remedial Response Activities -Development Process." March, 1987. EPA/540/G-87/003

"A Compendium of Superfund Field Operations Methods." December, 1987. NTIS PB88-181557; EPA/540/P-87/001

"Guidance for Conducting Remedial Investigations and Feasibility Under CERCLA. October, 1988. NTIS PB89-184626; EPA/540/G-89/004

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"Guidance Document for Cleanup of Surface Impoundment Sites." June, 1986. NTIS PB87-110664; EPA/9380.0-06

<u>Methods for Evaluating the Attainment of Cleanup Standards</u> - <u>Volume 1: Soils and Solid Media</u>. February, 1989.

NTIS PB89-234959.

"Compendium of ERT Soil Sampling and Surface Geophysics Procedures." January, 1991. EPA/540/P-91/006

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"Handbook for Stabilization/Solidification of Hazardous Wastes." June, 1986. EPA/540/2-86/001

"Compendium of ERT Waste Sampling Procedures." January, 1991. EPA/540/P-91/008

Sources of Documents

Center for Environmental Research Information (CERI) (no charge)

Center for Environmental Research Information (CERI) ORD Publications 26 West Martin Luther King Drive Cincinnati, OH 45268 (513) 569-7562

Public Information Center (PIC) (no charge)

U. S. Environmental Protection Agency Public Information Center (PIC) PM-211B 401 M Street, S.W. Washington, DC 20460 (202) 382-2080

Superfund Docket and Information Center (SDIC) (no charge)

U.S. Environmental Protection Agency Superfund Docket and Information Center (SDIC) OS-245 401 M Street, S.W. Washington, DC 20460 (202) 382-6940

National Technical Information Services (NTIS) (cost varies)

National Technical Information Service U. S. Department of Commerce 5285 Port Royal Road Springfield, VA 22161

FORM IV-A: SITE INFORMATION SHEET

Sample No.'s:	Anal	yses Reques	sted:		
Facility Name:		EPA I.D. No.:			
Site Location (city, c	county, Long./Lat	.):			
Facility Type and Inf	formation (produc	cts, raw mat	terials, etc.)	·	
Data	Ct and Time			E., 4 E.,	
Date:	Start Time	· Wind	Т	End Time:	
Conditions: Sky			_	_	
Collectors:					
Container	Total No.		Accepting	Laboratory	
1 L Plastic					
1 L Glass		Cita State			
500 ml Glass			Contact		Phone
250 ml Plastic					
40 ml Vials		Container Course			
Amber Glass					
other					
Sample Iced? YES	NO Preservativ	ves Used?	YES NO		
Sample Types (circle): Mon. Well		Res. Well		un. Well	Indus. Well
		Leachate		reek	River
		Ditch		agoon	Lake
		Pond		ediment	Soil
		Sludge		and	Indus. Waste
Othon		Solid	Oi	ll .	
Other					
Sampling Plan (circle	a): grah/compo	cita ctatict	ical/randon	n/iudamental	
Sampling Flair (energy Sampling Equipment					
Sampling Equipment	t Oscu				
Equipment is (circle)): dedicated/deco	ntaminated			
Source of decon. wat					
Source of trip/field b					
Photos taken? YES NO No. of Photos:					
Constituents expecte			- 1,1		
Approximate concen					
< 10 ppm 100 p			0% > 15	5%	
Handling Precaution					
If yes, precautions:					
Results Due By:		Signature:			
- J ·		<i>U</i>			

FORM IV-B: SAMPLE INFORMATION SHEET

Facility Name:					
Sample I.D.:		Sample Control No.:			
Sample Location:					
Sample Date:/_	/	Tim	e Sampled:	: AM/	PM
Field Test(s)			(circle all applica		
Performed Well	Result	Mon. Well	Res. Well	Mun. Well	Ind.
——————————————————————————————————————		Leachate Lagoon	Creek Lake	River Pond	Ditch
Sediment		-			v 1
Waste		Soil	Sludge	Sand	Ind.
		Solid	Oil		
Other		Blank (Equipn	nent/Trip/Field)	Background	
Containers	No.	Preservatives		Lab/Lot No.	
1 L plastic		H ₂ SO ₄ (50%)			
1 L glass			.)		
500 ml glass)		
40 ml vial		Zinc Acetate (2N)			
250 ml plastic		Other			
1L amber glass		Sample Iced			
Other		No preservativ	es used		
		for non-aqueous samples			
Additional Sample Loc	cation Information:				
Additional Sample Ob colloidal, etc.):	servations (e.g.: depth	taken, color, odo	r, size, clarity, de	nsity, suspended	d solids,
Sampling Equipment U	Used:				
Deviations from Samp Signature of Sampler:	ling Plan:				

FORM IV-C: GROUNDWATER SAMPLE INFORMATION SHEET

Facility Name/Location:					
Sample I.D.:	Sample Control No.:				
Sample Location:	<u>-</u>				
Sample Date:/ Time Sampled:: AM/PM					
Field Test(s)					
Performed Result	Sample Types (circle all applicable):				
TemperatureEC	Monitoring Well Other				
pH	Residential Well Grab/Composite				
Spec. Condµmhos	Municipal Well Split Sample				
	Duplicate of Background				
	Blank (Equipment/Trip/Field)				
Containing	December 1 at March Na				
Containers No.	Preservatives Lab/Lot No.				
1 L plastic	H ₂ SO ₄ (50%)				
1 L glass	HNO ₃ (conc.)				
500 ml glass 40 ml vial	NaOH (50%)				
	Zinc Acetate (2N				
250 ml plastic	Other				
Other	Sample Iced: yes / no				
Monitoring Well Data	Purged with: PUMP / BAILER				
Well Ident.	PUMP - type size				
Reference point on (steel/	make				
plastic) casing top BAILER - (PVC/SS/Te	eflon/other)				
Casing Stickup	diamlengthcapacity				
Depth to Water	rope material				
Well Material (PVC/SS/Teflon)					
Depth of Well	<u>Filtration Method</u> : gravity/vacuum/pressure				
Inside Diam., in. (1 2 4 6)	Filter: (cartridge/paper)				
Time to recharge 1 well vol:	typesizepore				
< (1 4 8 24 48) or >48 hrs.	pH Meter S.C. Meter				
Other Observations					
Was Sample filtered prior to preservation? Y	ES NO				
Color of water before filtration: Aft	er filtration:				
	ES NO				
Appearance of Water: (Clear / Slightly Turbid	/ Very Turbid)				
Well purged (< />) (1 2 4 6 12 24 48) hours pr					
Purged approximately to dryness (1 2 3 4 5 8 10					
Signature:	Date:				

5.0 SAMPLE CUSTODY

Following a strict chain-of-custody protocol assists in tracking samples through the shipment and analysis process and provides protection in the event of federal action or third Party liability. Unlike data submitted in relation to regulatory issues such as enforcement cases or compliance with permits, data reported to the IDEM by applicants in the VRP will not be invalidated for reasons such as a chain-of-custody form being filled out improperly or an incorrect date being entered. However, a minimal chain-of-custody effort will be required. Because of the question of potential third Party liability which would necessitate legal defensibility, it is strongly recommended that applicants in the IDEM VRP maintain a *strict* chain-of-custody protocol.

A. Custody Defined

The custody sequence can be divided into three major segments: collection (field), laboratory analysis, and final evidence files. Within any of these segments, a sample or evidence file is in someone's custody if:

- 1. It is in his/her actual physical possession;
- 2. It is in his/her view, after being in his/her physical possession;
- 3. It is in his/her physical possession, and he/she has placed it in a secure (locked) location;
- 4. It is in a designated secure area.

For each segment in the sequence, the following states the minimal custody documentation required by the VRP.

B. <u>Field Chain-of-Custody Procedures</u>. VRP Field Custody Requirements.

- a. The field sampler is personally responsible for the care and custody of the samples until transferred.
- b. The sampler will keep a written record of the sampling operation and samples' identities. This documentation must include the following:
 - (1) Information equivalent to that requested on the example Site Information Sheet, Form IV-A above.
 - (2) A site map as described in Section 4.D.3., above accurately indicating sample collection points.
 - (3) Information equivalent to that requested on the example Sample Information Sheet or the example Groundwater Sample Information Sheet, Forms IV-B and IV-C, above, for *each* sample collected including blanks, spikes, and duplicates.
 - (4) A chain-of-custody document providing all information, signatures, dates, etc., equivalent to the example Chain-of-Custody sheet provided as Form V-A, below.

c. Each sample will be placed in a container with a completed sample label attached. The sample label must include, at a minimum: the sample number, the date and time sampled, the sample location, the parameters for which the sample is to be analyzed, and the sampler's signature.

- d. Samples remain in the custody of the sampler until transfer of custody is completed. This consists of:
 - (1) Delivery of samples to the laboratory sample custodian, and
 - (2) Signature of laboratory sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.
 - (3) If a carrier is used to take samples between the sampler and the laboratory, the carrier must also sign the chain-of-custody form (as receiver from sampler and relinquisher to laboratory).

C. Laboratory Chain-of-Custody Procedures VRP Laboratory Custody Requirements.

The following procedures must be followed by the laboratory:

- a. All samples will be handled by the minimum number of people possible.
- b. The laboratory will set aside a secured sample storage area consisting of a clean, dry, refrigerated, isolated room. This room should be capable of being locked if deemed necessary.
- c. A specific person or persons will be designated custodian(s). All incoming samples must be received by the custodian who will indicate receipt by signing the chain-ofcustody form.
- d. The sample custodian will maintain a bound logbook or other official record keeping system to record the following information for each sample: person delivering sample, person receiving sample, date and time received, source of sample, sample identification of log number, mode of transportation to laboratory, and condition in which sample received. A standardized format must be maintained.
- e. The custodian will ensure that samples which are heat-sensitive, light-sensitive, or radioactive, or which require special handling in other ways, are properly stored and maintained prior to analysis.
- f. The analytical area will be restricted to authorized personnel only.
- g. After sample analyses are complete, the laboratory may discard samples only with the concurrence of the sampler. If sample is discarded, time and date must be recorded. Analytical data is to be kept secured and released to authorized personnel only.

C. Final Evidence Files Chain-of-Custody Procedures

The minimal final evidence files chain-of custody requirements will be as follows:

The facility participating in the IDEM VRP or its designated contractor is the custodian of the evidence file. The evidence file is to include all reports; logs; field notebooks and other field records; pictures; contractor and subcontractor reports; correspondence; originals of laboratory reports, notebooks, and data; chain-of-custody documents; IDEM communications; and other records relevant to the VRP project. The applicant must maintain the evidence file in a secured, limited access area until all submittals for the VRP project, including the final report:

- (1) have been reviewed and approved by the IDEM, and
- (2) for a minimum of three years past the submittal date of the final report. Securing the evidence file for a longer period of time is at the discretion of the applicant.

FORM V-A: CHAIN OF CUSTODY

-	-	amples were collected b	by me or in my presence.	
Lab. Sample <u>No.</u>	Internal Sample No.	Mon. Well No./ Sampling Point <u>Identification</u>	No. of Containers (glass/plastic)	Date and and Time of Collection
				;am/pm;am/pm;am/pm;am/pm;am/pm;am/pm;am/pm;am/pm;am/pm;am/pm
				;am/pm ;am/pm ;am/pm
		mperatures During Col Custody: (1)EC (_	MaxEC MinEC
		TRANSFER	OF CUSTODY	
Relinquishe	at I received the alged By: Date & Time	_	Received By: Date & Time	
Title:		:am/pm	Title:	:am/pm
Title:		 :am/pm	Title:	am/pm
Title:		 :am/pm	Title:	
		LABORATORY RE	ECEIPT OF SAMPLES	
custody of o		rsonnel or will be secur	ceipt is officially recorded ed in a locked area at all t Laboratory Time	times.

6. CALIBRATION PROCEDURES AND FREQUENCY

A. General

This section of the QAPP describes procedures for maintaining the accuracy of all instruments and measuring equipment used for conducting field tests and laboratory analyses. The instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

Equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency (specify the frequency) and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specification.

Equipment to be used doing the field sampling will be examined to certify that it is operating condition. This includes checking the manufacturing's operating manual and the instruction and the instructions for each instrument to ensure that maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out. A spare electrode will be sent with each pH meter to be used for field measurements. Two thermometers will be sent to sampling locations where measurement of temperature is required, including those locations where a specific conductance probe/thermometer is required.

Calibration of field instruments is governed by the specific Standard Operating Procedure (SOP) for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instruments will include a pH meter, thermometer, nephelometer, specific conductivity meter, portable gas chromatograph, and Organic Vapor analyzer (OVA) or Organic Vapor Photoionization Detector (PID). In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

All applicants must include the following information regarding analytical methodology and calibration in the Calibration Procedures section of the QAPP or, when applicable, the Sampling and Analysis portion of the Workplan:

- 1. The analytical methods to be used should be listed.
 - (a) Standard, non-modified U.S. EPA need only be referenced.
 - (b) Non-standard or modified methods must be described.
 - (c) Any and all field methods or mobile laboratory methods must be described.
- 2. For any non-standard, modified, field, or mobile laboratory methods planned for use detailed, instrument-specific calibration SOPs must be appended. This also applies to any referenced standard methods which do not include detailed calibration procedures.

3. Standards to be used for calibration must be listed. Information regarding standards' source(s), traceability, and purity checks must be provided.

- 4. Frequency of initial and continuing calibration checks must be provided.
- 5. Specific acceptance criteria for all calibration measurements must be defined.

B. VRP Program Recommendations and Requirements

1. SW-846 or CLP

Applicants wishing to insure against third Party liability, or who wish to follow strict RCRA or Superfund protocols for other reasons, may elect to use only SW-846 (RCRA) or CLP SOW (Superfund) analytical methods and adhere to specified calibration procedures and acceptance criteria exactly. Each SW-846 and CLP SOW method provides a detailed calibration procedure with specified acceptance criteria.

2. VRP Program Requirements

For applicants not electing to follow strict SW-846 or CLP protocols, calibration procedures and frequencies must meet or exceed the guidelines listed in the analytic method utilized for analysis. In addition, special attention should be given to describing analytical methodology and calibration procedures as requested in paragraphs 6.A.1. and 6.A.2, above; this is especially important for field and mobile laboratory methods.

7.0 ANALYTICAL PROCEDURES

This section of the QAPP (or, when applicable, the Sampling and Analysis portion of the Workplan) should identify and provide detailed information about all analytical methods to be used for both critical and non-critical parameters for all sample matrices. Information regarding sample preparation and cleanup methods should be included. The name and location of the laboratory performing the analyses should also be provided.

If U.S. EPA standard methods are used without major modifications, they need merely be referenced. However, preparatory methods should also be indicated. If minor modifications must be made to accommodate site-specific conditions (e.g., detection limits, sample preparation procedures, data validation procedures), such modifications should be described.

If standard methods are not used, a description of the cleanup, preparation, and analytical methods should be described, and detailed SOPs of each, including and internal quality control checks, should be appended to the QAPP.

A table summarizing preparatory and analytical methods should be included within this section indicating any matrix specific differences.

8.0 Internal Quality Control Checks

This section should include the following:

A. An identification of all stages in the sampling and analytical process where the QC activity will occur.

B. What Quality Control will be utilized (i.e., MS/MSD, blanks mass tuning, etc.) as appropriate for each analytic method?

9.0 Data Reduction, Validation, and Reporting

A. General

This section of the QAPP should include the following information:

1. Data Reduction

- a. Identification of responsibility for data reduction,
- b. Summary of data reduction procedures, and
- c. Summary of statistical approach for reducing data, if used.

2. Data Validation

- a. Identification of responsibility for data validation,
- b. Procedures for determining outlines and flagging data, and
- c. Identification of critical control points.

3. <u>Data Reporting</u>

- a. Identification of responsibility for data reporting and
- b. Identification of critical control points.
- B. <u>VRP Requirements</u>

10.0 PERFORMANCE AND SYSTEM AUDITS

A. <u>Audit Recommendations</u>. Quality audits in the field and in the laboratory will ensure that all QA requirements are met. Audits can be performed by internal personnel and/or by external assessors. For the purposes of the VRP, only internal audits will be addressed. Any analytical laboratory chosen should include internal performance and system audits as part of its documented QA/QC program. In the field, the Field QA Officer or Sampling Team Leader should conduct system audits; for the purposes of the VRP, performance audits will not apply to the field.

B. Audits Defined

1. A Performance Audit is an independent check by a person or an audit team designated by management (i.e., the QA Officer or QA group) to evaluate the data produced by a laboratory's analytical system. It is sometimes categorized as a *quantitative appraisal of quality*.

Performance audits will include data reviews and may consist of the following:

- Analysis worksheet reviews,
- b. On-site analyst work review/observation,
- c. Intralaboratory check sample or "blind" sample analysis and review,

- d. Interlaboratory check sample or "round robin" samples' analysis and review,
- e. Analyst proficiency test sample analysis review.
- 2. <u>A System Audit</u> is an on-site inspection and review of a laboratory's or field operation's quality control system and procedures. It is sometimes categorized as a *qualitative appraisal of quality*. It will cover the operational elements of the QA program.
 - a. <u>In the field</u> the system audit may include:
 - (1) examination of sampling records,
 - (2) field instrument operating records,
 - (3) maintenance of QA procedures in sampling practices and obtaining QC samples, and
 - (4) chain-of-custody documentation, etc.

If field analyses or mobile lab analyses are performed, field audits will be expanded to include review of field measurement records, instrumentation calibration and maintenance records, and review to ensure QA procedures such as MS/MSD analyses have been performed.

- b. In the laboratory the system audit may include:
 - (1) sample handling: receipt, documentation, and storage procedures;
 - (2) sample preparation and analysis: existence and adherence to written SOPs;
 - (3) records control;
 - (4) chain-of-custody procedures and documentation;
 - (5) examination of instrument records, including preventive maintenance; and
 - (6) Staffing concerns: workload, training, proficiency testing, personnel practices.

11.0 PREVENTIVE MAINTENANCE

Preventive maintenance of field and laboratory equipment includes routine procedures to be carried out with each use, routine procedures to be carried out at scheduled intervals, and procedures to be carried out on an as needed basis. Each instrument should have a bound logbook in which all scheduled and unscheduled maintenance is recorded in detail.

- 12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS.
- 13.0 CORRECTIVE ACTIONS

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Note: This Section should include the following:

- Individuals submitting and receiving reports
- Type of Report
- Written or oral frequency
- Interim or final QA/QC reporting is required in final reports
- Contents of various reports
- Summary of QA/QC programs, training and accomplishments
- Results of technical systems and performance evaluation
- Significant QA/QC problems, recommended solutions, and results of corrective actions
- Data quality assessment in terms of precision, accuracy, representativeness, completeness, comparability, and method detection limit
- Indication of whether the QA objectives were met
- Limitations on use of the measurement data

APPENDIX C: BASELINE ECOLOGICAL ASSESSMENT

Selection of appropriate cleanup criteria for sites in the voluntary remediation program will be based, in part, on ecological concerns. A baseline ecological assessment will be completed as part of the Phase II Investigation for all sites. Use of Tier II (human health based) criteria to remediate a site will depend on results of the baseline ecological assessment; use of Tier I (background) criteria should not be impacted by results of the baseline ecological assessment.

The baseline ecological assessment will be conducted primarily as a desktop review and walk through inspection to determine if critical habitats are present at the site or if critical habitats could potentially be impacted by contaminants associated with the site. Table C-1 provides a listing of critical habitats that should be considered in making the decision of Tier selection.

If no critical habitat(s) is (are) present at the site and if there is no potential for habitat impacts from the site, Tier II criteria can be used. If there is a potential for habitat impacts from the site and the applicant wishes to use Tier II criteria, an investigation will be needed to determine if the habitat has been impacted. If impacts are discovered, then Tier II criteria will not apply. If no impacts are discovered, a determination will need to be made if the Tier II remedy will be protective of the habitat. A limited ecological risk assessment which is site specific, contaminant of concern specific and critical habitat of concern specific is anticipated to answer the question of Tier II acceptability. A flow chart of steps in the determination of the appropriate Tier (cleanup criteria) is presented in Figure C-1.

TABLE C-1. CRITICAL HABITATS TO BE CONSIDERED IN CHOICE OF APPROPRIATE CLEANUP CRITERIA (TIER) FOR THE VOLUNTARY REMEDIATION PROGRAM.¹

Surface waters (streams and lakes or ponds);

Wetlands:

Critical Habitat for endangered/threatened plant and animal species;

Habitat used by designated or proposed endangered/threatened plant and animal species;

Riparian areas (stream banks);²

Breeding areas for forest nesting birds, aquatic birds, aquatic mammals, amphibians, or reptiles;

Migratory stopover areas for migrant shorebirds, aquatic birds, raptors or passerines;

Wintering areas for migratory waterfowl or other aquatic birds;

Forest Areas:

Sinkholes or Karst channel re-charge areas;

Hatcheries;

Parks;

Nature Preserves or Reserves;

Fish and Wildlife Management, Conservation, Refuge, or Research Areas;

Nongame Conservation Areas;

Designated Natural Areas;

Reservoir Areas;

Recreation Areas;

Prairie Areas;

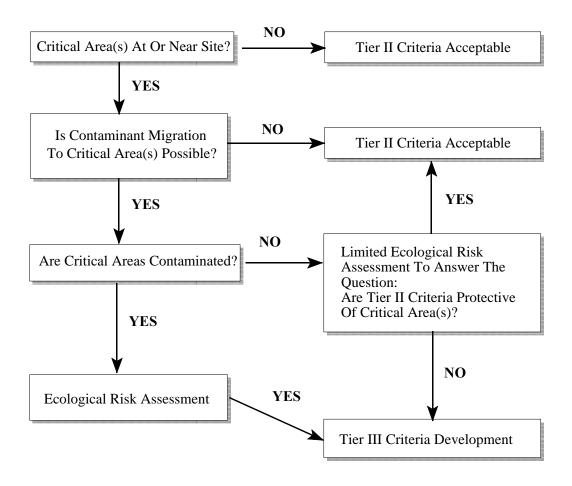
Dune Areas (Lake Michigan near shore areas);

Other Designated Critical Biological Resource Areas

Use of Tier I cleanup criteria (background) is considered appropriate for all sites regardless of presence of critical areas.

Floodplains - Federal and State Laws contain regulations for activities in Floodplains.

INDIANA VOLUNTARY REMEDITAION PROGRAM FLOWCHART FOR TIER II OR TIER III



FLOWCHART OF DECISIONS NECESSARY TO DETERMINE ACCEPTABLILITY OF TIER II OR NECESSITY TO DEVELOP TIER III CLEANUP CRITERIA FOR THE INDIANA VOLUNTARY REMEDIATION PROGRAM CRITICAL AREA DETERMINATION WILL BE RESULT OF BASELINE ECOLOGICAL ASSESSMENT

FIGURE C-1: TIER II OR TIER III FLOWCHART

APPENDIX D: PROJECT COMPLETION SAMPLING

In order to ascertain cleanup goal achievement or if long term control devises are working, a final sampling or monitoring plan needs to be implemented. This plan will cover a minimum of one of the following matrices:

soils ground water surface water sediments

In addition there are some program specific guidance that may need to be followed. Any underground storage tank cleanups will need to follow the criteria outlined in the UST Site Closure Guidelines and RCRA cleanups will need to follow that protocol. The following is designed to be followed in a generic sense whenever other program directives are not applicable.

SOILS

Following the completion of the remediation, a soil confirmation sampling program should be implemented. The purpose of this program is to verify that the remediation is complete and that constituents of concern are not present above the cleanup objectives.

No less than 4 samples shall be taken from areas where soils have been excavated or treated regardless of the size of the cleanup area. Samples shall <u>not</u> be composited and shall be taken from areas representative over the site. In addition any discolored soils that will be left in place shall be sampled to determine if cleanup levels were attained. The samples need to be taken at the bottom of any excavation and from the side walls to delimit the cleanup zone. Samples should be from a horizon no more than 6" into the base or sidewall of the excavation.

If only surface soils are removed or treated the samples should be aerially placed and representative. All samples are to be taken within the same 6" depth. No individual sample should be submitted from greater than a 6" horizon. If a large amount of material is needed multiple scoops can be taken from the same general area.

The analytical parameters to be tested for from each location are those for which the applicant wishes a Covenant Not to Sue.

However, based on sampling conducted prior to remediation, the number of parameters may be reduced. For instance, if the site investigation demonstrated that semivolatile organic compounds are not present, the confirmation sampling need not include them even though the covenant not to sue will cover these compounds.

The selection of the number and location of soil confirmation samples is a site-specific issue. For remediations involving soil excavation, the confirmation sampling may be conducted using a random sampling technique as outlined below. However, applicants may submit alternative sampling procedures

or a different number of samples per quadrant or section, which is better suited for their facility. Applicants proposing alternative sampling procedures should provide a technical justification.

It should be noted that while random sampling may be appropriate for confirmation sampling, it may not be appropriate for sampling conducted during investigations. During investigations directed sampling may be more appropriate.

Guidance for random soil sampling is as follows:

- 1. Make a diagram of the site or facility and divide the area to be sampled into sections of equal area. If the area is under 40,000 square feet, then it should be divided into four equal quadrants. If the area is over 40,000 square feet, it should be divided into sections of not more than 10,000 square feet.
- 2. Divide each quadrant or section into an imaginary 10 X 10 grid to get 100 squares (or rectangles) of equal size. Number the grid lines in each dimension from 0 to 9.
- 3. Four samples per section or quadrant should be collected at random locations if the area to be remediated is greater than 2,500 square feet. If the area is less than 2,500 square feet, 2 samples per quadrant should be collected at random locations.
- 4. Select a two-digit number using a random number table. Repeat this procedure until you have one two-digit number for each sampling point in each section. (Random number tables are available in any introductory statistics text or in SW-846.)
- 5. Locate the grid intersections whose coordinates correspond to each of the two-digit random numbers. These intersections are the locations of the randomly selected sampling points.
- 6. The area should also be inspected for visual or olfactory evidence that contamination remains. If discolored soil, soil emitting a noticeable odor, or other evidence that contamination remains are present, additional samples should be obtained from the areas emitting the odor or showing a visual impact.

The sampling method, container, and preservative should be consistent with those outlined in SW-846. Samples for volatile and semi-volatile organic compounds should not be mixed or stirred before being placed in the sampling container.

Unless pre-remediation sampling has clearly defined the horizontal extent of contamination, confirmation samples should also be obtained along the excavation wall. Sample locations should be every 50 feet along the excavation perimeter. At each location, samples should be obtained for each five feet of depth of the excavation. The depths where samples are obtained must be those which represent the preferred migration pathway.

Soil samples should be collected from discreet six-inch intervals. If the volume of soil required for testing exceeds that of the six-inch interval, the interval may be extended or samples may be obtained from directly adjacent soils. Under no conditions should soils being tested for volatile or semi-volatile organic compounds be homogenized prior to being placed in containers.

In-situ remediations may require a sampling strategy different from that outlined above.

DETERMINING SOIL BACKGROUND CONCENTRATIONS

Background concentrations of naturally occurring compounds or compounds not related to the site are determined by collecting samples from a minimum of four locations. Locations must not be impacted by the site or the facility. Background is defined as the sample mean plus three standard deviations. If the excavation extends downward through several soil horizons, background concentrations must be determined for each horizon.

GROUND WATER

Ground water samples need to be taken over a period of time to determine if a cleanup has been effective and contamination is in fact decreasing. Preference to sampling quarterly over a one year period should be given. At a minimum all monitoring wells that were impacted need to have concentrations that are below action levels for four consecutive quarters. If asymptotic levels are to be considered samples must be taken over eight consecutive quarters. If contaminant values are at or below action levels for four straight months an exception to quarterly sampling can be made. All ground water analysis submitted must be from unfiltered sampling.

SURFACE WATER

Surface water samples should be taken from down stream of any out fall or discharge point using National Pollutant Discharge Elimination Systems (NPDES) or Ambient Water Quality Criteria (AWQC) protocol.

SEDIMENTS

Sediments are a compilation of heterogenous materials found in fresh and marine waters: Solids composed of organic and inorganic materials which grade from very coarse (gravel) to very fine (clay) grained; Interstitial fluid, (water which fills the pore spaces between grains); A benthic community; and Contaminants derived from surface runoff, ground water discharge and chemical precipitation.

The dynamics of sediment formation and characterization preclude requiring one particular sampling or classification method. In general, samples should be taken in a manner that will cause the least amount of disturbance. Loss of fine materials and interstitial water need to be minimized because these fractions may contain contaminants of most interest. Rather than list all of the various test and classification methods the following sources are given for reference and guidance in sampling, testing and classifying sediments:

Burton, G. Allen. "Sediment Toxicity Assessment". Lewis Publishers, Inc. Chelsea, MI 48118 (1992). USEPA/USACE. 1991. United States Environmental Protection Agency/United States Army Core of Engineers. Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual). February 1991. United States Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington DC 20460. USEPA-503/8-91/001.

USEPA. 1992. United States Environmental Protection Agency. Sediments Classification Methods Compendium. September 1992. United States Environmental Protection Agency, Office of Science and Technology, Washington DC 20460. EPA-823-R-92-006.

APPENDIX E: TECHNICAL STANDARDS

Introduction

A technical standards subcommittee was formed by the Indiana Department of Environmental Management (IDEM) to provide guidance and recommendations to the agency on technical issues affecting implementation of the Voluntary Remediation Program (VRP). The VRP was established by the 1992 Indiana General Assembly in Senate Enrolled Act 392 and required IDEM to establish the VRP by July 1, 1993. The technical standards subcommittee was composed of volunteers from IDEM, industry, consultants, attorneys and environmental groups who met monthly to develop these recommendations. This summary encapsulates the work performed by this group and the individual volunteers. Along with this summary is a list of policy issues which the subcommittee was not able to resolve before the July 1, 1993 deadline.

BACKGROUND

The goals of the subcommittee were to establish technical guidelines and instructions for applying to the VRP and preparing and reviewing VRP work plans. To accomplish the work plan goals, the subcommittee reviewed and commented on draft work plan Guidance prepared by the IDEM implementation contractor and developed recommendations regarding cleanup criteria. As a part of the work on cleanup criteria, the subcommittee prepared guidance for laboratory testing in the Quality Assurance Project Plan (QAPP) provided in Appendix B, page 51. Cleanup criteria recommendations represent the bulk of the work conducted by the subcommittee. The final subcommittee recommendations are summarized below.

RECOMMENDATIONS

The recommendations developed by the subcommittee were developed from a review of cleanup programs established by other states modified slightly by local conditions. This summary does not review the mechanisms, iterations or consensus building that was undertaken to develop the final recommendations, however, the recommendations do address the vast majority of the comments received by the subcommittee. In developing the recommendations, it became apparent that a series of definitions would be required to ensure that agency and applicant exceptions were known. The recommendations therefore begin with definitions followed by a summary of the cleanup criteria with a final summary of the means for demonstrating compliance with the criteria.

DEFINITIONS

<u>Aquifer</u> - a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs.³

<u>Contaminant</u> - any solid, semisolid, liquid, or gaseous matter, or any odor, radioactive material, pollutant as defined in the Federal Waste Pollution Control Act, hazardous waste as defined by the Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.), as amended, or any combination thereof, from whatever source, that: (A) is injurious to human health, plant or animal life, or property;

(B) interferes unreasonably with the enjoyment of life or property; or (C) is otherwise violative of this article or rules adopted under this article.⁴

<u>Free Product</u> - the separate phase material present in concentrations greater than a contaminant's residual saturation point.⁶

<u>Groundwater</u> - subsurface water in a zone of saturation, which can be brought to the surface of the ground or to surface waters, through wells, springs, seepage, or other discharge areas. A zone of saturation is where all the voids and pore spaces in the rock, soil or geological materials are filled with water.²

<u>Hazard Quotient</u> - the ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period.⁷

<u>Hazardous Substance</u> - "Hazardous Substance" means any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. Or any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or if otherwise emitted to the environment.¹

<u>Institution Controls</u> - a mechanism used, as a supplement to engineering controls, to limit human activities at or near a contaminated site, or to ensure the effectiveness of the remedial action over time, when contaminants remain at a site in concentrations either above the cleanup standards that would be applicable if the site were residential property, or that may otherwise present an unacceptable risk to human health or the environment. Institutional controls may include, without limitation, structure, land and natural resource (for example, water) use and deed restrictions, well restriction areas, deed notices and access controls.⁶

Non-Residential Property - any real property, at which activities are being conducted, having the primary Standard Industrial Classification(SIC) major group numbers 01-48 inclusive, 49 except 4941. 50-67 inclusive, 72-79 inclusive, 80 except 8051, 8059, 8062, 8063, 8069, 81 and 82 except 8211, 8221, 8222, 83 except 8351, 8361, 84-86 except 8661, 87, 89-91 inclusive, 92 except 9223, and 93-97 inclusive. Non-residential property includes all of the block(s) and lot(s) controlled by the same owner or operator that are vacant land, or that are used in conjunction with such business. For leased properties non-residential property includes the leasehold and any external tank, surface impoundment, septic system, or any other structure, vessel, contrivance, or unit that provides, or is utilized for the management of contaminants to or from the leasehold. 5,9

<u>Petroleum</u> - petroleum asphalt and crude oil or any part of petroleum asphalt or crude oil that is liquid at standard conditions of temperature and pressure (sixty (60) degrees Fahrenheit) and fourteen and seven-tenths (14.7) pounds per square inch absolute.¹

<u>Practical Quantitation Limit</u> - the lowest level at which a chemical may be accurately and reproducibly quantitated. Usually equal to the detection limit multiplied by a factor of 3 to 5, but varies between chemicals and between samples.⁷

<u>RCRA</u> - the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended, 42 U.S.C. 6907, et seq.³

<u>Receptor</u> - any human, ecosystem or part thereof, surface water, well (other than a monitoring well), structure (for example, a basement), which is or may be affected by a contaminant from a site.⁶

<u>Release</u> - any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, including the abandonment or discarding of barrels, containers, or other closed receptacles containing any hazardous substance or petroleum.¹

<u>Residential Property</u> - any property that does not exclusively meet the definition of non-residential property. Residential property includes any otherwise non-residential property that is used in part for residential activities, such as a day care center at a non-residential property.⁵

<u>Remediation</u> - any of the following:

- (1) Actions necessary to prevent, minimize, or mitigate damages to the public health or welfare or to the environment, which may otherwise result from a release or threat of a release.
- (2) Actions consistent with a permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance or petroleum into the environment to eliminate the release of hazardous substances or petroleum so that the hazardous substances or petroleum do not migrate to cause substantial danger to present or future public health or welfare to the environment.
- (3) The cleanup or removal of released hazardous substances or petroleum from the environment.¹

<u>Sediment</u> - a compilation of heterogenous materials found in fresh and marine waters: Solids composed of organic and inorganic materials which grade from coarse (gravel) to very fine (clay) grained; Interstitial fluid, water which fills the pore spaces between grains; A benthic community; and Contaminants derived from surface runoff, ground water discharge and chemical precipitation. ⁸

<u>Site</u> - a parcel of real estate for which an application has been submitted. Specifically that portion of the real estate which will be subjected to investigation or remediation under this program. ¹

<u>Soil</u> - the unconsolidated mineral and organic matter on the surface of the earth that has been subjected to and influenced by geological and other environmental factors.⁶

<u>Soil Layer</u> - all soil within a common geologic horizon that is at least three feet thick and has a common United States Department of Agriculture textural classification.⁸

<u>Subsurface Soil</u> - the soil more than two feet below grade and extending downward to the top of the seasonally high water table.⁶

Surface Soil - the top two feet of soil below grade.⁶

<u>Total Organic Contaminants</u> - those analytes determined from the summation, of all analytes and from their respective concentrations, as determined from all pertinent organic analytical methodologies employed.⁶

<u>Total Petroleum Hydrocarbons</u> - those materials which can be extracted from sample matrices with Freon 113 having chemical characterizations which allow passage of the extract through a silica gel column with detection at 2,970 cm⁻¹±150 wave number using either a fixed wave length or scanning wavelength infrared detector. Petroleum hydrocarbons may also be characterized by gas chromatography fingerprint analysis.⁶

<u>Total Volatile Organic Contaminants</u> - analytes whose vapor pressure is > 1mm Hg at normal temperature (20 degrees C) and pressure (1 atm) and may be sampled by static and dynamic heated and ambient temperature headspace analysis, direct injection, and thermal desorption of the sample or sampling media, separated by either packed or capillary columns and analyzed by specific detectors (such as Hall, PID, FID, TCD, or PFD) or a universal detector (such as a mass spectrometry).⁶

<u>Water Table</u> - the upper surface at which the fluid pressure of the ground is equal to atmospheric pressure.⁴

<u>Wetlands</u> - those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.⁴

CLEANUP CRITERIA

Cleanup criteria for sites within this program is recommended to consist of a combination of performance and quantitative standards. The performance standards will essentially apply to all cleanups, however, a caveat will apply to sites which cannot comply with the performance standards because of practical considerations or technological limitations. Quantitative standards will be based on a three tiered approach which consists of background levels, generic risk based standards and site specific risk based standards.

PERFORMANCE STANDARD

Remediation shall prevent or minimize future releases and migration of hazardous substances and petroleum in the environment. Prevention and minimization of releases shall be accomplished to the extent practical and technologically feasible by removing and/or controlling the source of the release and any free product associated with the release. Remediation shall provide long-term care or management, where necessary, including but not limited to monitoring, operation and maintenance, as appropriate.

QUANTITATIVE STANDARDS

Quantitative standards have been developed which provide guideline limits for various chemicals in soil

and groundwater. An applicant may select any one of three tiers of cleanup criteria: Tier I, Tier II or Tier III.

TIER I

Tier I levels will be established on a site specific basis using the same procedures required for determining background levels at RCRA regulated cleanups. Tier I levels for synthetic organic chemicals (SOC) will be the practical quantitation limit. Tier I levels for soil contaminated with chemicals other than SOCs soils will be established by collecting a minimum of four samples and computing the mean and standard deviation of this data. The Tier I cleanup level will be equal to the background mean value plus three times the standard deviation.

The database for computation of Tier I levels for surface soils will consist of laboratory analyses of samples collected from the upper two feet of soil at a minimum of four locations in the vicinity of the site. Samples should be collected at six inch intervals (0-6", 6-12", 12-18" and 18-24") and the depth intervals should be combined into one composite sample from each location for laboratory analysis. The laboratory results from the four (or more) composite samples will then serve as the database for statistical computation.

The database for computation of Tier I levels for subsurface soils will consist of laboratory analyses of samples collected from the same soil layer slated for investigation or remediation. If multiple soil layers will be subjected to investigation or remediation, then samples must be collected from each layer. A minimum of four samples must be collected from different locations within each layer. The samples must then be subjected to laboratory analysis and these results will serve as the database for statistical computation. Tier I levels will be established for each appropriate soil layer using these techniques. Tier I levels for groundwater will be established by collecting groundwater samples from a location which is hydraulically upgradient of the site and which is unaffected by site contamination. The samples must be collected from the same aquifer and aquifer interval (i.e. top, middle or base, as appropriate) which will be subjected to investigation or remediation. If multiple aquifers (or aquifer intervals) are slated for investigation or remediation Tier I levels must be established for each. A minimum of four groundwater samples must be collected and subjected to laboratory analysis. At a minimum, the samples must be collected monthly over a four month period, although quarterly sampling over one year is preferable. The four periods of background data will be used to compute the background mean and standard deviation.

TIER II

Tier II levels will be established using standard equations for risk assessment as established by the USEPA for risk assessments under Superfund. IDEM has established default values for the equations. A detailed discussion of the derivation of Tier II levels is provided in Appendix F (page 99) along with a table of Tier II levels.

Since the Tier II levels are based solely on human exposures, the levels may not be sufficiently protective of ecological impacts. Guidance on determining potential ecological impacts provided in the Section entitled "Selecting Cleanup Levels".

The use of Tier II levels for industrial properties will result in a use restriction that will be placed on the Covenant Not to Sue.

TIER III

Tier III levels will be established on a site specific basis using methodology that is provided in the applicant's work plan. Tier III levels may be required for a unique type of contaminant, an environmentally sensitive site or other unique site-specific conditions. Tier III levels can be based on a site specific risk assessment or any other technique proposed by the applicant. Tier III can also be used to modify default values used in Tier II computations if site conditions are different than the Tier II assumptions. Tier III can also be used for contaminants for which no Tier II levels have been computed because of lack of toxicological data. IDEM will be responsible for reviewing and approving all Tier III proposals for establishing cleanup levels.

SELECTING CLEANUP LEVELS

The applicant is responsible for proposing the cleanup levels to be used for the site. IDEM is responsible for reviewing and approving the use of the levels as proposed. As a part of the selection processes, the applicant will be required to perform a baseline ecological assessment to determine if potential ecological impacts are associated with the site that could invalidate the use of the Tier II criteria. The requirements for baseline ecological assessment are included in Appendix C, page 85.

DEMONSTRATING COMPLIANCE

In order to receive a Certificate of Completion, an applicant must demonstrate compliance with the performance and quantitative standards.

PERFORMANCE STANDARD

Compliance with the performance standards will require submittal of evidence that the source of the contamination has either been removed or controlled by the implemented remediation. Evidence will also have to be submitted that all free product has been removed from the site or that a system is in place to remove all free product from the site. If it is technologically infeasible or impractical to achieve these performance standards, evidence must be submitted to prove this assertion.

QUANTITATIVE STANDARDS

Demonstrating compliance with the quantitative standards will require submittal of sampling and analytical results from project completion sampling. Details of the minimum requirements for project completion sampling are provided in Appendix D. If the arithmetic mean of all project completion soil samples is below the cleanup levels and no sample contains contaminants at concentrations greater than 10 times the cleanup level, it will be concluded that the remediation complied with the soil cleanup level. Compliance with the groundwater cleanup levels will be considered after completion of a statistically valid comparison between the cleanup standard and the project completion sampling results indicates no statistically significant difference between the two data sets.

POINT OF COMPLIANCE

Project completion sampling must be performed at the point of compliance to demonstrate compliance with the quantitative standards. The point of compliance for soil contamination is throughout the soil layers which have been subjected to investigation or remediation. The point of compliance for groundwater contamination is the downgradient limit of the site within the aquifer(s) or aquifer intervals that have been subjected to investigation or remediation. Alternative points of compliance may be considered for Tier III criteria depending on unique contaminant or site characteristics.

REFERENCES

- #1 Senate Act #392
- #2 Groundwater Task Force
- #3 329 IAC 3-1-7
- #4 329-IAC 2-2-1
- #5 Texas Register, December 18, 1992, 31 TAC 335.552
- #6 New Jersey Register, February 3, 1992, NJAC 7.26D-1.7
- #7 Environmental Acronyms, Abbreviations and Glossary of Terms. Source: United States Environmental Protection Agency Information Resources Directory, Spring 1989 OPA 003-89. Published by: Executive Enterprises, Inc.
- #8 VRP Technical Subcommittee
- #9 Standard Industrial Classification Manual; Executive Office of the President Office of Management and Budget, 1987 NTIS Order no. PB 87-100012.

APPENDIX F: TIER II CLEANUP GOALS - HUMAN HEALTH EVALUATION

Cleanup goals for chemicals in source media for Tier II are calculated based on a human health evaluation using standard risk assessment assumptions. Cleanup goals are determined for one of two possible land use scenarios; residential or nonresidential. The determination of whether cleanup goals based on a residential or nonresidential scenario apply to a particular site depends on the environmental site setting (i.e., onsite and surrounding land use patterns) and projected future use. However, the use of cleanup goals to remediate a site based on a nonresidential scenario will require some land use restrictions to prevent unrestricted future use of the site.

The methodology for calculation of Tier II, health-based cleanup goals was based on EPA's preliminary remediation goals (EPA, 1991), incorporating changes agreed upon by the Voluntary Remediation Program Technical Standards Subcommittee. The methodology for calculation of Tier II cleanup goals is provided in three parts. This first part presents background information and an overview of the health-based approach for determining preliminary remediation goals. Then detailed calculations are provided which outline the approach for calculating health-based goals specifically for the Tier II assessment. Finally, cleanup goals for selected compounds are presented that are applicable for remediation of sites with a Tier II assessment.

OVERVIEW OF EPA APPROACH FOR DETERMINING PRELIMINARY REMEDIATION GOALS

EPA has identified a standardized approach for calculating cleanup goals or preliminary remediation goals (PRGs) for the remedial investigation and feasibility study (RI/FS) process on federal Superfund sites. PRGs are equivalent in concept to Tier II cleanup goals such that they are health-based acceptable concentrations for chemicals of interest in a particular media. They are also derived independently for a site or sites without requiring a site-specific risk assessment (i.e., a Tier III risk assessment). The method for calculating these PRGs was outlined in the document *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual; Part B, Development of Risk-Based Preliminary Remediation Goals* (EPA, 9285.7-01B, December, 1991), an overview of which is discussed below.

EPA's approach for determining PRGS for a site include either applicable or relevant and appropriate requirements (ARARs) and/or health-based acceptable concentrations. This discussion, however, focuses only on the calculation of risk-based PRGs. Risk-based PRGs are calculated separately by chemical and media. The media evaluated in EPA Part B include soils and groundwater (and/or surface water used as a potable water source). However, for Tier II, soils were divided into two separate media based on their potential for exposure: surface soils and subsurface soils. Surface soils are defined as those soils within the top 2 feet of the surface that would be incidentally contacted by a worker, while working, or by residents while playing (young children) and/or landscaping or gardening (adults). Subsurface soils were defined as soils below 2 feet that would only be contacted directly during excavation or construction activities. The potential for contact to subsurface or deeper soils would be less than for surface soils and would occur under different circumstances (i.e., excavation or construction).

The development of risk-based PRGs begins with the determination of the probable future land use of the site and the potential receptor type that would apply. Potential exposure pathways are then identified using assumptions about the behavior and body parameters of the applicable receptor. For calculation of PRGs for each media, EPA identified applicable exposure pathways specific to the land use scenario evaluated. However, EPA only considered those exposure pathways that contribute significantly to the overall exposure and risk in the calculation of PRGs. Other relevant exposure pathways were assumed to contribute insignificantly to the overall exposure and were not included. Relevant exposure pathways were also assumed to vary according to residential and nonresidential use scenarios. For the residential scenario, the exposure pathways considered applicable for groundwater were ingestion and inhalation of volatiles; and for soil was incidental ingestion. For the nonresidential scenario, the exposure pathways considered applicable for determining PRGs for groundwater was ingestion; and for soil were incidental ingestion and inhalation of volatiles and fugitive dusts.

Once exposure pathways are identified, equations quantifying the health risk to the receptor can be developed. There are two general equations used in calculating potential human health effects in a risk assessment, one for carcinogenic effects, the other for noncarcinogenic effects. They are, for the carcinogenic assessment:

$$R_i$$
' SF (I_i Equation (1)

where: R_i = excess lifetime cancer risk from exposure pathway i;

 $SF = cancer slope factor (mg/kg/day)^{-1};$

 I_i = total chemical intake from exposure pathway i averaged over a lifetime

(mg/kg/day)

and, for the noncarcinogenic assessment:

$$HI_i = \frac{I_i}{RfD}$$
Equation (2)

where: $HI_i = \text{hazard index from exposure pathway } i$;

 I_i = average daily intake from exposure pathway i averaged over the period of

exposure (mg/kg/day);

RfD = reference dose (mg/kg/day).

Equations 1 and 2 are written in a general form in that chemical intake (I) varies according to exposure pathway and receptor. Total cancer risk and hazard index are then calculated by summing across all exposure pathways to give a total cancer risk (R_{tot}):

$$R_{tot}$$
 ' $E R_i$ **Equation (3)**

or total hazard index (HI_{tot}):

 HI_{tot} ' $E HI_i$ Equation (4)

The equations quantifying the risk from a given chemical concentration in a particular medium can then be inverted to back-calculate a health-based acceptable chemical concentration, given an acceptable risk level. PRGs are then determined by using these equations with standard EPA default exposure factors, available toxicity data and appropriate target health effect levels. EPA designed the PRG methodology to be used initially to calculate PRGs for a site using strictly default parameters, and, at a later time, to be used with site-specific assumptions to update the PRGs. However, application of the PRGs concept for calculating Tier II cleanup goals assumes only the default parameters. Modification based on site-specific data, however, could be implemented as a part of a Tier III risk assessment.

Toxicity data refers to cancer slope factors (SFs) and reference doses (RfDs), collectively termed dose-response factors, used in Equations 1 and 2. Dose-response factors relate the intake or dose of a chemical to a carcinogenic effect or noncarcinogenic systemic effect from exposure to a contaminated medium. Dose-response factors are specific to a chemical and exposure pathway (i.e., oral versus inhalation). SFs and RfDs are obtained first from EPA's Integrated Risk Information System (IRIS), or if not available in IRIS, from EPA's Health Effects Assessment Summary Tables (HEAST).

Target health effect levels refer to the levels of cancer risks or hazard indices that are deemed acceptable by the EPA for a particular site. Target health effect levels are cancer risks and hazards indices below which the potential for effects to human health are assumed to be negligible or inconsequential. Generally, cancer risks are evaluated based on a range of acceptable risk from 1 in 10,000 (10⁻⁴) to 1 in a 1,000,000 (10⁻⁶). Noncarcinogenic effects are evaluated based on a hazard index of one or below which is generally deemed to be acceptable. The range of acceptable risk for the carcinogenic assessment reflects the range of uncertainty in the analysis and interpretation of the results for a particular site. This range also reflects the range of acceptability for various land uses. For federal Superfund sites investigated under the national contingency plan (NCP), sites with a cumulative total cancer risk level below 10⁻⁶ for all applicable receptors indicate no remedial action is needed. Whereas, for sites with cancer risk levels above 10⁻⁴, some remedial action must be taken to mitigate potential cancer risks. For sites with maximum cancer risks in the range 10⁻⁴ to 10⁻⁶, action is taken on a sitespecific basis. Typically on sites with unrestricted future use (i.e., where residential use is possible), the target risk level is closer to 10⁻⁶. However, on sites with restricted land uses for current and future nonresidential purposes, target risk levels higher than 10⁻⁶ are often selected. Therefore, for determining health-based cleanup goals for carcinogens in the Tier II analysis, a "point of departure" for sites with unrestricted future use (i.e., including residential use) was based on a 10⁻⁶ target cancer risk level. For sites where current and future land use is restricted to nonresidential purposes, the "point of departure" for carcinogens was the 10⁻⁵ target cancer risk level. The target hazard index used for evaluating noncarcinogenic compounds was 1, for compounds that are not considered bioaccumulative, and 0.2, for compounds that are considered bioaccumulative. Table 1 of Water Quality Criteria for Specific

Substances (Indiana Register, Volume 16, Number 7, April 1, 1993) was the basis for determining whether or not a compound was considered bioaccumulative.

CALCULATION OF HEALTH-BASED CLEANUP GOALS

Health-based cleanup goals were calculated for soils and groundwater according to EPA's PRG approach, with one exception. Cleanup goals for soils were developed separately for surface and subsurface soils since they differ in the potential for direct contact exposure. Cleanup goals for surface soils were based on EPA's PRG approach considering target receptors of either residents, for sites remediated for unrestricted future use, or construction workers, for sites that are remediated for restricted land use for nonresidential purposes. For subsurface or deep soils, applicable receptors are excavation workers (i.e., for utility placement or maintenance) or construction workers. These particular receptors would be exposed to subsurface soils at a higher rate (i.e., higher contact rate per day or event) than a construction worker or resident would be exposed to surface soils, but the exposure would occur over a shorter duration. The following paragraphs provide a discussion of calculating health-based criteria applicable for the nonresidential and residential land use scenarios.

NONRESIDENTIAL LAND USE SCENARIO

<u>Surface Soils:</u> Potential exposure pathways considered applicable for surface soils in the nonresidential scenario were incidental ingestion and inhalation of volatiles and fugitive dusts. The cancer risk, R, and hazard index, HI, for these exposure pathways by a worker are calculated using equations written in the form of Equations 1 and 2, however they are expanded to consider specific formulas for calculating

$$R \stackrel{!}{=} \frac{EF (ED (C_s (SF_o (IR_{soil} (10^{\&6} Kg/mg) \%SF_i (IR_{air} ((1/VF \% 1/PEF)))}{BW (AT (365 days/yr)}$$
Equation (5)

intake (I_i) as follows, for carcinogens:

and for noncarcinogens:

HI '
$$\frac{EF$$
 (ED (C_s ($1/RfD_o$ (IR_{soil} ($10^{\&6}$ Kg/mg) % $1/RfD_i$ (IR_{air} ($1/VF$ % $1/PEF$)) BW (AT ($365days/yr$ Equation (6)

The variables VF (soil to air volatilization factor) and PEF (particulate emissions factor) relate the exposure concentrations for the chemical in air to source concentration in soil. The values of VF and PEF are calculated according to the following equations:

$$VF (m^3/kg) \cdot (\frac{LS (V (DH))}{A}) (\frac{(3.14("(T)^{1/2})^{1/2}}{2(D_{ei} (E (K_{sa} (10^{&3}kg/g)$$
Equation (7)

where:

"
$$(cm^2/s)$$
" $\frac{D(E)}{E\%}$

Equation (8)

and

PEF
$$(m^3/kg)$$
 ($\frac{LS$ (V (DH ($3600s/h$) ($\frac{1000g/kg}{0.036}$ ($(1\&G)$ ($(U_m/U_t)^3$ ($F(x)$

The definitions of variables in Equations 5 through 9 and their EPA recommended default values are provided in Table 1. Equations 5 and 6 above provide numeric estimates of cancer risk (R) and noncarcinogenic hazard index (HI) as a function of the concentration of a chemical in soil. These equations can be inverted to solve for the soil concentration which becomes the health-based criteria (C_{goal}) for a particular compound, as follows:

$$C_{goal}$$
 ' BW (THI (AT ($365days/year$
 EF (ED ($1/RfD_o$) ($10^{\&6}kg/mg$ (IR_{soil} % ($1/RfD_i$) (IR_{air} ($(\frac{1}{VF}\%\frac{1}{PEF})$)
 Equation (10)

and

$$C_{goal} ' = \frac{BW (TR (AT (365 days/year) + EF (ED (SF_o (10^{\&6} kg/mg (IR_{soil} \% SF_i (IR_{air} ((\frac{1}{VF} \% \frac{1}{PEF})) + Equation (11))}{Equation (11)}$$

where: TR = target cancer risk level; and

THI = target hazard index.

The above expression allows for the explicit calculation of a soil health-based criteria once target cancer risk and hazard index levels are established.

Under the default assumptions presented in Table 1, and assuming a target cancer risk level (TR) of 10⁻⁵ and target hazard index (THI) of 1 for the nonresidential scenario, the above two equations reduce to:

$$C_{goal} = \frac{2.9 (10^{\&3})}{5 (10^{\&5} (SF_{o}) \% SF_{i} (VF \% 4.3 (10^{\&9}))}$$
Equation (12)

and

$$C_{goal} \ \ \frac{102}{5 \ (10^{\&5}/RfD_{o}) \ \% \ \ 1/RfD_{i} \ (\frac{20}{VF} \ \% \ 4.3 \ (10^{\&9}) \ }$$
 Equation (13)

<u>Subsurface Soils:</u> As with surface soils, potential exposure pathways applicable for a construction or excavation worker exposed to subsurface soils are incidental ingestion and inhalation of volatiles and fugitive dusts. The cancer risk and hazard index for constructions workers were calculated and combined for these exposure pathways based on Equation 5 for carcinogens and Equation 6 for noncarcinogens. The parameter definitions for variables specific for construction workers exposed to subsurface soils are provided in Table 2. As with surface soils, health-based criteria (C_{goal}) for subsurface soils are calculated based on inverting Equations 5 and 6 and generating equations similar to 10 and 11.

Under the default assumptions presented in Table 2, and assuming a target cancer risk level (TR) of 10⁻⁵ and THI of 1 for construction workers in the industrial scenario, Equations 10 and 11 reduce to:

$$C_{goal}$$
 ' $\frac{5.1 (10^{\&2})}{(1 (10^{\&4} (SF_{o}) \% SF_{i} (VF \% 4.3 (10^{\&9})))}$
Equation (14)

and

$$C_{goal}$$
 ' $\frac{146}{(1 (10^{8.4}/RfD_{o}) \% [1/RfD_{i} (\frac{20}{VF} \% 4.3 (10^{8.9})])}$
Equation (15)

<u>Groundwater:</u> The exposure pathway considered applicable for groundwater in the industrial land use scenario is ingestion. Cancer risks and hazard indices from this exposure pathway is calculated in equations that combine these intake assumptions as follows, for potential carcinogens:

$$R \stackrel{!}{=} \frac{EF \stackrel{!}{=} ED \stackrel{!}{=} C_w \stackrel{!}{=} SF_o \stackrel{!}{=} IR_w}{BW \stackrel{!}{=} AT \stackrel{!}{=} 365 \frac{days/yr}{Equation (16)}$$

and, for noncarcinogens:

HI'
$$\frac{EF (ED (C_w (IR_w))}{RfD_o (BW (AT (365 days/yr))}$$
Equation (17)

The definitions of variables in Equations 16 and 17, and the EPA recommended default values are provided in Table 3. Equations 16 and 17 present health effects as a function of concentration of chemical in groundwater. These equations can be inverted to solve for water concentrations or health-based criteria (C_{goal}) for groundwater as follows:

$$C_{goal}$$
 TR (BW (AT (365 days/yr EF (ED (SF_o (IR_w Equation (18)

and

$$C_{goal}$$
 ' $\frac{THI$ (RfD_o (BW (AT ($365 \ days/yr$ EF (ED (IR_w Equation (19)

If the default assumptions presented in Table 3 are used and a target cancer risk of 10⁻⁵ and target hazard index of 1 are assumed, the above equations reduce to, for carcinogens:

$$C_{goal}$$
 $\frac{2.86 \text{ (} 10^{\&3} \text{)}}{SF_o}$

Equation (20)

and, for noncarcinogens

$$C_{goal}$$
 ' 102.2 (RfD_o Equation (21)

RESIDENTIAL LAND USE SCENARIO

<u>Surface Soils:</u> The potential exposure pathway applicable for surface soils in the residential scenario was incidental ingestion. The equations of risk to a resident from soil ingestion are slightly different from the nonresidential scenario as the ingestion rate is weighted to account for the change in body weight and ingestion rate as a resident child ages into a resident adult. The equations to be used to calculate cancer risk and hazard index from soil ingestion under a residential scenario are:

$$R_{ing}$$
 ' $\frac{SF_o$ (C_s ($10^{\&6}$ Kg/mg (EF ($IF_{soil/adj}$ AT (365 days/year **Equation (22)**

and for noncarcinogens:

$$HI_{ing}$$
 ' $\frac{C_s \ (10^{\&6} \ Kg/mg \ (EF \ (IF_{soil/adj})^2)}{RfD_o \ (AT \ (365 \ days/year)^2}$
Equation (23)

where $IF_{soil/adj}$ is the time-weighted average soil ingestion rate for residents divided body weight. Unlike the soil ingestion rate (IR_{soil}) used for a worker, $IF_{soil/adj}$ is a parameter that accounts for the changing rate of soil intake as a child grows into a young adult in a residential setting. The variable $IF_{soil/adj}$ was calculated by the equation:

$$IF_{soil/adj}(mg\&yr/Kg\&day)' \quad \frac{IR_{soil/age1\&6}(ED_{age1\&6})}{BW_{age1\&6}} \% \frac{IR_{soil/age7\&31}(ED_{age7\&31})}{BW_{age7\&31}}$$
 Equation (24)

The definitions of parameters in Equations 22, 23 and 24, and the EPA recommended default values are provided in Table 4. Equations 22 and 23 specify cancer risks and hazard indices as a function of soil concentration. These equations can be inverted to solve for soil concentrations or health-based criteria (C_{coal}) for surface soil as follows:

$$C_{goal}$$
 ' $\frac{TR \text{ (}AT \text{ (}365days/year)}{SF_o \text{ (}10^{\&6}kg/mg \text{ (}EF \text{ (}IF_{soil/adj})\text{ }}$
Equation (25)

and

$$C_{goal}$$
 ' $\frac{THI (AT (365 days/year))}{1/RfD_o (10^{86} kg/mg (EF (IF_{soil/adj})))}$
Equation (26)

where: TR = target cancer risk level; and

THI = target allowable hazard index.

If the default assumptions presented in Table 4 are used and a target cancer risk of 10^{-6} and target hazard index of 1 are assumed, the above equations reduce to:

$$C_{goal} = \frac{0.64}{SF_o}$$
Equation (27)

and

$$C_{goal}$$
 ' 2.7 ($10^5 (RfD_o)$
Equation (28)

<u>Subsurface Soils:</u> As with subsurface soils in the nonresidential scenario, subsurface soils in the residential scenario are assumed to only be contacted during excavation or construction activities. Therefore, the assumptions and equations determined for the nonresidential scenario would be applicable for the residential scenario. Thus, cleanup goals for subsurface soils in the residential scenario are the same as those determined for the nonresidential scenario.

<u>Groundwater:</u> Potential exposure pathways considered applicable for groundwater in the residential land use scenario include ingestion and inhalation of volatiles. Cancer risks and hazard indices from these two exposure pathways are calculated in equations that combine these intake assumptions as follows, for potential carcinogens:

$$R = \frac{EF (ED (C_w (SF_o (IR_w) \% (SF_i (K (IR_a))))}{BW (AT (365 days/yr))}$$
Equation (29)

and, for noncarcinogens:

HI '
$$\frac{EF \ (ED \ (C_w \ ((1/RfD_o \ (IR_w) \% \ (1/RfD_i \ (K \ (IR_a)) BW \ (AT \ (365 \ days/yr) Equation (30))$$

The definitions of variables in Equations 29 and 30, and the EPA recommended default values are provided in Table 5. Equations 29 and 30 present health effects as a function of concentration of chemical in groundwater. These equations can be inverted to solve for water concentrations or health-based criteria (C_{goal}) for groundwater as follows:

$$C_{goal}$$
 ' $\frac{TR (BW (AT (365 days/yr EF (ED ((SF_o (IR_w) % (SF_i (K (IR_a)) Equation (31))))}{ER (BW (AT (365 days/yr (AT (365 days/yr (AT (SF_o (AT (S$

and

$$C_{goal}$$
 ' $\frac{THI \ (BW \ (AT \ (365 \ days/yr) \ EF \ (ED \ (1/RfD_o \ (IR_w) \% \ (1/RfD_i \ (K \ (IR_a)) \ Equation (32)$

If the default assumptions presented in Table 5 are used and a target cancer risk of 10⁻⁶ and target hazard index of 1 are assumed, the above equations reduce to, for carcinogens:

$$C_{goal}$$
 ' $\frac{1.7 \text{ (} 10^{\&4} \text{ }}{\text{(2 (} SF_o) \% \text{ (7.5 (} SF_i) \text{ }})}$
Equation (33)

and, for noncarcinogens

$$C_{goal}$$
 ' $\frac{60.8}{(2/RfD_o) \% (7.5/RfD_i)}$
Equation (34)

TIER II CLEANUP GOALS

Cleanup goals were calculated for a representative set of chemicals for the Tier II Voluntary Remediation Program based on the procedures outlined above. Table 6 presents this list of chemicals along with analytical detection limits and a determination of whether or not the compound is considered bioaccumulative. Table 7 presents appropriate chemical properties and dose-response data used for calculation of health-based criteria. This representative list of chemicals includes semi-volatiles, volatiles, pesticides and PCBs and inorganics (i.e., metals and cyanide). Literature sources for chemical property data include the following:

e Howard, P.H. 1989. Fate and Exposure Data for Organic Chemicals. Lewis Publishers, Chelsia Michigan.

- EPA, 1989. Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF) -Air Emissions Models. Appendix D: Properties for Chemicals of Interest. EPA-450/3-87-026. November, 1989.
- e EPA, 1986. *Superfund Public Health Evaluation Manual*. Appendix A: Summary Tables for Chemical-Specific Data. EPA/540/1-86/060. October, 1986.
- PADER, 1990. Risk Assessment/Fate and Transport Modeling System. Appendix B: Selected Parameter Values for Common Contaminants. Bureau of Waste Management, Pennsylvania Dept. of Environmental Resources. July 13, 1990.

Dose-response data were obtained from the Integrated Risk Information System (IRIS, 1993), and if not available in IRIS, from the Health Effects Assessment Summary Tables (HEAST, 1992: with Supplemental Updates Nos. 1 and 2). Only dose-response data for chemicals with toxicity data from IRIS (1993) and HEAST (1992) were used with the exception of potentially carcinogenic PAHs. Seven of the priority pollutant PAHs are classified as B2 probable carcinogens (IRIS, 1992) as follows:

- @ benzo(a)pyrene;
- e chrysene;
- @ benzo(a)anthracene;
- @ benzo(k)fluoranthene;
- @ benzo(b)fluoranthene;
- @ dibenzo(a,h)anthracene; and
- @ indeno(1,2,3-c,d)pyrene.

However, EPA-verified CSFs only exist for benzo(a)pyrene (IRIS, 1992). Therefore, cancer slope factors are needed to perform a carcinogenic assessment for the other 6 potentially carcinogenic PAHs. EPA is currently considering evaluating the carcinogenicity of the other potentially carcinogenic compounds based on a toxicity equivalency factor (TEF) approach relative to carcinogenicity of benzo(a)pyrene. An interim draft policy for evaluating the carcinogenicity of the other PAHs was released in 1990 (EPA, 1990. *Draft Interim Policy for Estimating Carcinogenic Risks Associated With Exposures to Polycyclic Aromatic Hydrocarbons (PAHs)*, OSWER Directive #9285-4-02). This draft interim policy first identified the TEF approach for assessing the carcinogenicity of PAHs other than benzo(a)pyrene. This was further supported by a recent EPA memo from Kenneth A. Poirer, Director of Superfund Health Risk Technical Support Center for Chemical Mixtures and Assessment Branch, concerning PAH toxicity (*Risk Assessment for Polyaromatic Hydrocarbons*, Memo to Sarah Levinson, EPA Region 1, January, 1992). Also, the Environmental Criteria and Assessment Office (ECAO) of EPA in Cincinnati was contacted concerning the appropriate methodology for the carcinogenic assessment of PAHs. Dr. Rita Schoeny, Associate Director of Science for ECAO, stated that a TEF approach is appropriate for evaluating the carcinogenicity for the other six potentially carcinogenic PAH

compounds using the TEF factors relative to that of benzo(a)pyrene. These TEF factors are as follows:

	PAH COMPOUND		<u>TEF</u>	<u>CSF</u>
С	benzo(a)pyrene	_	1	7.3
С	benzo(a)anthracene	-	0.1	0.73
C	benzo(b)fluoranthene	-	0.1	0.73
C	benzo(k)fluoranthene	-	0.01	0.073
C	chrysene	-	0.001	0.0073
C	dibenzo(a,h)anthracene	-	1.0	7.3
C	indeno(1,2,3-c,d)pyrene	-	0.1	0.73

Therefore, with the absence of verified EPA CSFs for PAHs other than benzo(a)pyrene, PAHs carcinogenicity were assessed based on the TEF approach, suggested by EPA and recommended by Dr. Schoeny of EPA's ECAO.

An overview of health-based cleanup goals by scenario (residential and nonresidential) and by media are provided below.

NONRESIDENTIAL SCENARIO

<u>Groundwater:</u> Cleanup goals for groundwater in the nonresidential scenario were determined based on health-based criteria from direct contact using the default Equations 20 and 21. However, for implementation purposes for a site remediation program, health-based concentrations were compared to practical quantitation limits (PQLs) and drinking water criteria (i.e., non-zero maximum contaminant level goals [MCLGs] or maximum contaminant levels [MCLs] from the Safe Drinking Water Act) for determination of the cleanup goal. The practical quantitation limit is the lowest level that can be reliably achieved for a particular analyte within specified limits of precision and accuracy during routine laboratory operating conditions for a particular procedure. PQLs were determined based on *Test Methods for Evaluating Solid Waste* (EPA, 1986; SW-846). Representative test methods considered applicable for compounds in water include:

- @ Method 8270 for semi-volatiles;
- @ Method 8240 for volatiles:
- Method 8080 for pesticides and PCBs;
- Method Series 200 for metals and inorganics.

However, final PQLs would vary according to the specific analytical method used. Health-based concentrations were first compared to PQLs. For those compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. Finally, health-based concentrations were compared to drinking water quality criteria (i.e., non-zero MCLGs and MCLs). For those compounds with criteria below MCLGs or MCLs, the cleanup goal were based on applicable drinking water criteria.

Table 8 presents applicable drinking water criteria, PQLs and health-based concentrations that were used to determine Tier II cleanup goals for groundwater in the nonresidential scenario (i.e., on sites

remediated for restricted future use). Health-based concentrations for carcinogens in the nonresidential scenario were calculated assuming a 10⁻⁵ target risk level. Health-based concentrations for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative. Cleanup goals identified as NA for particular compounds indicate appropriate toxicity data is not available or not appropriate for that particular compound. For some compounds, cleanup goals were determined from both the carcinogenic and noncarcinogenic assessment. The appropriate cleanup goal would, therefore, be the lower of the two values. For other compounds, such as lead, no toxicity values were available and therefore, health-based cleanup goals could not be calculated based on this methodology. However, there are data available to assess cleanup goals for compounds such as lead, such as MCLs or other EPA documentation which should be consulted.

<u>Surface Soils:</u> Cleanup goals for surface soils in the nonresidential scenario were determined based on health-based concentrations from direct contact using the default Equations 12 and 13. However, health-based concentrations were compared to practical quantitation limits (PQLs) for determination of the cleanup goal. The consideration of PQLs was considered necessary for application of cleanup goals to site remediation programs. For compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in surface soil according to the following criteria:

- e total semi-volatile compounds not to exceed 10,000 mg/Kg;
- e total volatile compounds not to exceed 1,000 mg/Kg;
- e total cyanide concentrations of 1,000 mg/Kg; and
- e total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria. No upper limit has been established for metals other than mercury since many are naturally occurring, some of which at high concentrations.

Table 9 presents PQLs and health-based concentrations that were used to determine Tier II cleanup goals for surface soils in the nonresidential land use scenario (i.e., on sites remediated for restricted future use). Cleanup goals for carcinogens in the nonresidential scenario were calculated assuming a 10⁻⁵ target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

<u>Subsurface Soils:</u> Cleanup goals for subsurface soils in the nonresidential scenario were determined based on two health-based criteria: direct contact using the default Equations 14 and 15; and based on leaching to groundwater and protection of a groundwater criteria or standard. The leaching pathway was not considered in the calculation of PRGs, however, the leaching of chemicals from soils to groundwater and the protection of groundwater was deemed an important consideration for establishing cleanup goals for subsurface soils. Soil concentrations that are considered protective of groundwater via leaching were calculated based on EPA's Organic Leaching Model (OLM) [*Final Organic Leaching Model (OLM)*; EPA 51 FR 41082, Nov. 13, 1986], which involves the equation:

$$C_l$$
' 0.00221 ($C_s^{0.678}$ ($Sol^{0.373}$ **Equation (35)**

where: C_1 = Concentration in the leachate (mg/L);

 C_s = Concentration in the soil or solid media (mg/Kg); and

Sol = Aqueous solubility (mg/L).

By substituting a groundwater cleanup goal (C_{gw}) for C_1 in Equation 35 and re-arranging term, an acceptable subsurface soil concentration (C_s) is calculated with the equation:

$$C_s$$
 ' $\frac{C_{gw}}{\left(0.00221(\ Sol^{0.373}\right)}$ Equation (36)

The health-based criteria was the lower of the either the health-based concentration from the direct contact method or from the leaching method. However, as with surface soils, health-based criteria were compared to practical quantitation limits (PQLs) for determination of the final Tier II cleanup goal. This is necessary for implementation purposes in a remediation program on subsurface soils. For compounds having health-based criteria less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in subsurface soils, based on the discussion provided above for surface soils, including the following:

- e total semi-volatile compounds not to exceed 10,000 mg/Kg;
- e total volatile compounds not to exceed 1,000 mg/Kg;
- e total cyanide concentrations of 1,000 mg/Kg; and
- e total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria.

Table 10 presents PQLs and health-based concentrations from the direct contact and leaching methods for determination of Tier II cleanup goals for subsurface soils in the nonresidential land use scenario (i.e., on sites remediated for restricted future use). Cleanup goals for carcinogens in subsurface soils from the nonresidential scenario were calculated assuming a 10⁻⁵ target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

RESIDENTIAL SCENARIO

<u>Groundwater:</u> Cleanup goals for groundwater in the residential scenario were determined based on health-based criteria from direct contact using the default Equations 33 and 34. Health-based concentrations were compared to practical quantitation limits (PQLs) and non-zero maximum

contaminant level goals (MCLGs) or maximum contaminant levels (MCLs) from the Safe Drinking Water Act, for determination of the cleanup goal. Health-based concentrations were first compared to PQLs. For those compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. Finally, health-based concentrations were compared to drinking water quality criteria (i.e., non-zero MCLGs and MCLs). For those compounds with criteria below MCLGs or MCLs, the cleanup goal were based on applicable drinking water criteria. Analytical test methods for determining concentrations in residential drinking water detection methods must conform to current U.S. EPA drinking water methodology.

Table 11 presents applicable drinking water criteria, PQLs and health-based concentrations that were used to determine Tier II cleanup goals for groundwater in the residential scenario (i.e., on sites remediated for unrestricted future use). Health-based concentrations for carcinogens in the residential scenario were calculated assuming a 10⁻⁶ target risk level. Health-based concentrations for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

<u>Surface Soils:</u> Cleanup goals for surface soils in the residential scenario were determined based on health-based concentrations from direct contact using the default Equations 27 and 28. Health-based concentrations were compared to practical quantitation limits (PQLs) for determination of the cleanup goal. For compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in surface soils which include the following:

- e total semi-volatile compounds not to exceed 10,000 mg/Kg;
- e total volatile compounds not to exceed 1,000 mg/Kg;
- e total cyanide concentrations of 1,000 mg/Kg; and
- e total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria.

Table 12 presents PQLs and health-based concentrations that were used to determine Tier II cleanup goals for surface soils in the residential land use scenario (i.e., on sites remediated for unrestricted future use). Cleanup goals for carcinogens in the residential scenario were calculated assuming a 10⁻⁶ target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

<u>Subsurface Soils:</u> Cleanup goals for subsurface soils in the residential scenario were determined based on the discussion provided above for the nonresidential scenario. However, the applicable groundwater criteria for the leaching assessment were based on the groundwater criteria discussed above for the residential scenario. The health-based criteria was the lower of the either the health-based concentration from the direct contact method or from the leaching method. Health-based criteria were then compared to practical quantitation limits (PQLs) for determination of the final Tier II cleanup goal. For compounds having health-based criteria less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in subsurface soils which include the

following:

- e total semi-volatile compounds not to exceed 10,000 mg/Kg;
- e total volatile compounds not to exceed 1,000 mg/Kg;
- e total cyanide concentrations of 1,000 mg/Kg; and
- total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria.

Table 13 presents PQLs and health-based concentrations from the direct contact and leaching methods for determination of Tier II cleanup goals for subsurface soils in the residential land use scenario. Cleanup goals for carcinogens in subsurface soils from the residential scenario were calculated assuming a 10⁻⁶ target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

SUMMARY

This section discussed the calculation of cleanup goals for Tier II in the Voluntary Remediation Program. Cleanup goals were presented for surface soils, subsurface soils and groundwater separately for a residential and nonresidential land use scenario. Tier II cleanup goals were presented for representative compounds. Tables 14 and 15 present cleanup goals for the residential and nonresidential scenarios, respectively. Cleanup goals were determined based on health-based concentrations from a human health risk assessment. However, the determination of cleanup goals also considered practical quantitation limits (PQLs) based on available analytical methods for soils and groundwater. PQLs must be considered when establishing definable cleanup goals to be met in a site remediation program.

TABLE 1 INTAKE ASSUMPTIONS FOR EXPOSURE TO SURFACE SOILS IN THE NONRESIDENTIAL SCENARIO

Parameters	Definition (units)	<u>Default Value</u>
Assumptions F	or Calculation of Cleanup Goals for Surface Soi	il .
C_s TR THI Sf_o Sf_i RfD_o RfD_i	chemical concentration in soil (mg/Kg) target excess individual lifetime cancer risk (unit target acceptable hazard index (unitless) oral cancer slope factor (mg/Kg-day) ⁻¹ inhalation cancer slope factor (mg/Kg-day) ⁻¹ oral reference dose (mg/Kg/day inhalation reference dose (mg/Kg/day)	1 chemical-specific chemical-specific chemical-specific chemical-specific
EF ED Ir _{soil} Ir _{air} VF PEF	exposure frequency (days/yr) exposure duration (yr) soil ingestion rate (mg/day) inhalation rate (m³/day) volatilization factor (m³/Kg) particulate emissions factor (m3/Kg)	70yr - carcinogenic 25yr - noncarcinogenic 50 days/yr 25 yr 50 mg/day 20 m³/day (see Equation 7 and factors below) (see Equation 9 and factors below)
Assumptions fo	or Estimation of Volatilization Factor (VF)	
$\begin{array}{c} LS \\ V \\ DH \\ A \\ D_{ei} \\ E \\ K_{sa} \end{array}$	length of side of contaminated area (m) wind speed in mixing zone (m/s) diffusion height (m) area of contamination (cm²) effective diffusivity (cm²) true soil porosity (unitless) soil/air partition coefficient (g soil/cm³ air)	45 m 2.25 m/s 2 m 20,250,000 cm ² D _i x E ^{0.33} 0.35 (H/K _d) x 41, where 41 is a units conversion
$\begin{array}{c} p_s \\ T \\ D_i \\ H \\ K_d \end{array}$ $K_{oc} \\ OC \\ \end{array}$	true soil density or particulate density (g/cm³) exposure interval (s) molecular diffusivity (cm²/s) Henry's law constant (atm-m³/mol) soil-water partition coefficient (cm³/g) organic carbon partition coefficient (cm³/g) organic carbon content of soil (fraction)	factor 2.65 g/cm ³ 7.90e+08 s chemical-specific chemical-specific chemical-specific, or K_{oc} x OC chemical-specific site-specific, or 0.02

TABLE 1 Cont. INTAKE ASSUMPTIONS FOR EXPOSURE TO SURFACE SOILS IN THE NONRESIDENTIAL SCENARIO

Definition (units)	<u>Default Value</u>
or Estimation of Particulate Emission Factor (PEF)	
length of side of contaminated area (m)	45 m
wind speed in mixing zone (m/s)	2.25 m/s
diffusion height (m)	2 m
area of contamination (m ²)	$2,025 \text{ m}^2$
respirable fraction (g/m²-hr)	$0.036 \text{ g/m}^2\text{-hr}$
fraction of vegetative cover (unitless)	0
mean annual wind speed (m/s)	4.5 m/s
equivalent threshold value of windspeed at 10 m (m/s)	12.8 m/s
function dependent on U_m/U_t	0.0497
	length of side of contaminated area (m) wind speed in mixing zone (m/s) diffusion height (m) area of contamination (m²) respirable fraction (g/m²-hr) fraction of vegetative cover (unitless) mean annual wind speed (m/s) equivalent threshold value of windspeed at 10 m (m/s)

TABLE 2 INTAKE ASSUMPTIONS FOR EXPOSURE TO SUBSURFACE SOILS IN THE NONRESIDENTIAL AND RESIDENTIAL SCENARIOS

Parameters Definition (units) Default Value

Assumptions For Calculation of Cleanup Goals for Subsurface Soil

C_{s}	chemical concentration in soil (mg/Kg)	-
TR	target excess individual lifetime cancer risk (un	itless) 10^{-5} (industrial)
THI	target acceptable hazard index (unitless)	1
Sf_o	oral cancer slope factor (mg/Kg-day) ⁻¹	chemical-specific
Sf_i	inhalation cancer slope factor (mg/Kg-day) ⁻¹	chemical-specific
RfD_o	oral reference dose (mg/Kg/day)	chemical-specific
RfD_i	inhalation reference dose (mg/Kg/day)	chemical-specific
AT	averaging time (yr)	70 yr - carcinogenic
		2 yr - noncarcinogenic
EF	exposure frequency (days/yr)	175 5 days/wk, 35 weeks/yr
ED	exposure duration (yr)	2 yr
Ir_{soil}	soil ingestion rate (mg/day)	100 mg/day
Ir_{air}	inhalation rate (m³/day)	$20 \text{ m}^3/\text{day}$
VF	volatiliztion factor (m³/Kg)	(see Equation 7 and factors below)
PEF	particulate emissions factor (m³/Kg)	(see Equation 9 and factors below)

Assumptions for Estimation of Volatilization Factor (VF)

LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (cm ²)	$20,250,000 \text{ cm}^2$
D_{ei}	effective diffusivity (cm ²)	$D_{i} \times E^{0.33}$
E	true soil porosity (unitless)	0.35
K_{sa}	soil/air partition coefficient (g soil/cm³ air)	(H/K_d) x 41, where 41
	•	is a units conversion
		factor
p_{s}	true soil density or particulate density (g/cm ³)	2.65 g/cm^3
T	exposure interval (s)	7.90e+08 s
Di	molecular diffusivity (cm ² /s)	chemical-specific
Н	Henry's law constant (atm-m ³ /mol)	chemical-specific
K_d	soil-water partition coefficient (cm ³ /g)	chemical-specific, or
ū		$K_{oc} \times OC$
K_{oc}	organic carbon partition coefficient (cm ³ /g)	chemical-specific
OC	organic carbon content of soil (fraction)	site-specific, or 0.02

TABLE 2 Cont. INTAKE ASSUMPTIONS FOR EXPOSURE TO SUBSURFACE SOILS IN THE NONRESIDENTIAL AND RESIDENTIAL SCENARIOS

Parameters	<u>Definition (units)</u>	Default Value
Assumptions j	for Estimation of Particulate Emission Factor (PEF)	
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (m ²)	$2,025 \text{ m}^2$
RF	respirable fraction (g/m²-hr)	$0.036 \text{ g/m}^2\text{-hr}$
G	fraction of vegetative cover (unitless)	0
\mathbf{U}_{m}	mean annual wind speed (m/s)	4.5 m/s
U_t	equivalent threshold value of windspeed at 10 m (m/s)	12.8 m/s
F(x)	function dependent on U_m/U_t	0.0497

TABLE 3 INTAKE ASSUMPTIONS FOR EXPOSURE TO GROUNDWATER IN THE NONRESIDENTIAL SCENARIO

Parameters Definition (units) Default Value

Assumptions For Calculation of Cleanup Goals for Groundwater

CW	chemical concentration in water (mg/L)	-
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁵ (industrial)
THI	target acceptable hazard index (unitless)	1
Sf_o	oral cancer slope factor ((mg/Kg-day) ⁻¹)	chemical-specific
RfD_o	oral reference dose (mg/Kg/day)	chemical-specific
BW	adult body weight (Kg)	70 Kg
AT	averaging time (yr)	70 yr - carcinogenic
		25 yr - noncarcinogenic
EF	exposure frequency (days/yr)	250 days/yr
ED	exposure duration (yr)	25 yr
Ir	daily water ingestion rate (L/day)	1 L/day

TABLE 4 INTAKE ASSUMPTIONS FOR EXPOSURE TO SURFACE SOILS IN THE RESIDENTIAL SCENARIO

<u>Parameters</u>	Definition (units)		Default Value
Assumptions	For Calculation of Cleanup Goals for Surface Soil		
C_s	chemical concentration in soil (mg/Kg)		-
TR	target excess individual lifetime cancer risk (unitless)		10 ⁻⁶ (residential)
THI	target acceptable hazard index (unitless)		1
Sf_{o}	oral cancer slope factor (mg/Kg-day)-1		chemical-specific
RfD_0	oral reference dose (mg/Kg/day)		chemical-specific
AT	averaging time (yr)		70 yr - carcinogenic
			30 yr - noncarcinogenic
EF	exposure frequency (days/yr)		350 days/yr
ED	exposure duration (yr)		30 yr
$If_{soil/adj} \\$	age-adjusted ingestion factor(mg-yr/Kg-day)		114 mg-yr/Kg-day
Assumptions	for Calculation of IF _{soil/adj}		
BW $_{age\ 1-6}$	average body weight from ages 1-6 (Kg)		15 Kg
BW age 7-31	average body weight from ages 7-31 (Kg)		70 Kg
ED ages 1-6	exposure duration during ages 1-6 (yr)		6 yr
ED ages 7-31	exposure duration during ages 7-31 (yr)	24 yr	
IR soil/ages 1-6	ingestion rate of soil age 1 to 6 (mg/day)	-	200 mg/day
ID Soll/ages 1 o			100 /1

ingestion rate of soil all other ages (mg/day)

IR soil/ages 7-31

100 mg/day

TABLE 5 INTAKE ASSUMPTIONS FOR EXPOSURE TO GROUNDWATER IN THE RESIDENTIAL SCENARIO

Parameters Definition (units) Default Value

Assumptions For Calculation of Cleanup Goals for Groundwater

C_{w}	chemical concentration in water (mg/L)	-
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁶ (residential)
THI	target acceptable hazard index (unitless)	1
Sf_{o}	oral cancer slope factor ((mg/Kg-day) ⁻¹)	chemical-specific
RfD_o	oral reference dose (mg/Kg/day)	chemical-specific
SF_i	inhalation cancer slope factor ((mg/Kg-day) ⁻¹)	chemical-specific
RfD _i	inhalation reference dose (mg/Kg/day)	chemical-specific
BW	adult body weight (Kg)	70 Kg
AT	averaging time (yr)	70 yr - carcinogenic
		25 yr - noncarcinogenic
EF	exposure frequency (days/yr)	350 days/yr
ED	exposure duration (yr)	30 yr
IR_a	daily indoor inhalation rate (m³/day)	15m ³ /day
Ir_{w}	daily water ingestion rate (L/day)	2 L/day
K	volatilization factor (unitless)	$.0005 \times 1000 \text{ L/m}^3$
		(Andelman 1990)

TABLE 6
REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS

Chemical Name		Si punoamo	Contaminant	ContaminantContaminant	Practical	Practical or Estimated Quantitation Limits	INTERNET PRINTER	
İ	Compound	Considered	Level	Level Goal	Low Cont	Low Contaminated Soil	Groun	Groundwater
1.41		Bioaccumulatable (ves/no)	(MCL)	(MCLG)	Value (mo/Ko)	Method	Value (mg/L)	Method
	semivolatile	no	7 3		0.660	SW846 - 8270	0.01000	SW846 - 8270
acenanhthylene	semivolatile	ou			0.660	SW846 - 8270	0.01000	0.01000 SW846 - 8270
acenaphthene	semivolatile	OU			0.660	SW846 - 8270	0.01000	SW846 - 8270
fliorene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
phenanthrene	semivolatile	ou			099'0	0.660 SW846 - 8270	0.01000	SW846 - 8270
anthracene	semivolatile	ou			0.660	SW846 - 8270	0.01000	SW846 - 8270
fluoranthene	semivolatile	yes			099.0	0.660 SW846 - 8270	0.01000	SW846 - 8270
Dyrene	semivolatile	ou			099.0	0.660 SW846 - 8270	0.01000	0.01000 SW846 - 8270
henzo(a)anthracene*	semivolatile	yes	0.0001	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
chrysene*	semivolatile	yes	0.0002	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
benzo(h)fluoranthene*	semivolatile	yes	0.0002	0	099.0	0.660 SW846 - 8270	0.01000	SW846 - 8270
benzo(k)fluoranthene*	semivolatile	yes	0.0002	0	099.0	SW846 - 8270	0.01000	SW846 - 8270
henzo(a)pyrene	semivolatile	yes	0.0002		099.0	SW846 - 8270	0.01000	SW846 - 8270
indeno(1.2.3-cd)pyrene*	semivolatile	yes	0.0004	0	0.660	SW846 - 8270	0.01000	
dibenzo(a,h)anthracene*	semivolatile	yes	0.0003	0	099.0	SW846 - 8270	0.01000	SW846 - 8270
benzo(g.h.i)perylene	semivolatile	yes			099.0	SW846 - 8270	0.01000	
3,3'-dichlorobenzidine	semivolatile	ou u			1.300	SW846 - 8270	0.02000	SW846 - 8270
n-nitroso-di-n-propylamine	semivolatile	ou		-	099.0	SW846 - 8270	0.01000	SW846 - 8270
bis(2-chloroisopropyl)ether	semivolatile	OU			099.0	SW846 - 8270	0.01000	
4-chloroaniline	semivolatile	no			1.300	SW846 - 8270	0.02000	+
2-chloronaphthalene	semivolatile	no			099'0	0.660 SW846 - 8270	0.01000	SW846 - 8270
2.4-dinitrotoluene	semivolatile	ои			099.0	SW846 - 8270	0.01000	SW846 - 8270
hexachlorobutadiene	semivolatile	yes			099'0	0.660 SW846 - 8270	0.01000	SW846 - 8270
hexachloroethane	semivolatile	yes			0.660	0.660 SW846 - 8270	0.01000	SW846 - 8270
isophorone	semivolatile	ОП			099.0	SW846 - 8270	0.01000	SW846 - 8270
benzyl alcohol	semivolatile	ou			1.300	1.300 SW846 - 8270	0.02000	SW846 - 8270
bis(2-chloroethyl)ether	semivolatile	ou			099'0	SW846 - 8270	0.01000	0.01000 SW846 - 8270

TABLE 6 REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS

		Compound is	Maximum Maximum ContaminantContaminant	Maximum Contaminant	Practical	Practical or Retimated Oceanitical and inclined		ن
Chemical	Compound	Considered	Level	Level Goal	Low Cont	Low Contaminated Soil		IS
Хате	Type Bic	Bioaccumulatable b	(MCL)	(MCLG)	Value	Mathod	orou.	Groundwater
		(yes/no)	(mg/L)	(mg/L)	(mg/Kg)		(ma/L)	Doutain
nitrobenzene	semivolatile	ou			0.660	SW846 8270	5	OTCO 240119
1,2-dichlorobenzene	semivolatile	ou	0.6000	0.6000	0 660	SW846 - 8770		SW640 - 82/0
1,3-dichlorobenzene	semivolatile	no	0.6000	0 6000	0 660		_	3 W 640 - 62/0
1,4-dichlorobenzene	semivolatile	no no	0.0750	0.0750	0790			2 W 840 - 87/0
1,2,4-trichlorobenzene	semivolatile	04	00700	0.0700	0.000	3W646 - 82/0	_	SW846 - 8270
hexachlorobenzene	semivolatile		01000	0.0700	0.000	0.000 SW846 - 82/0		SW846 - 8270
hexachlorocyclopentadiene	semivolatile	ou	0.0500	0.0500	0.000	SW846 - 82/0		SW846 - 8270
n-nitrosodiphenylamine	semivolatile	ou		00000	0.000	SW840 - 82/U	_	SW846 - 8270
benzoic acid	semivolatile	OL .			0.000	3 W 840 - 82/U	<u> </u>	SW846 - 8270
2-nitroaniline	semivolatile	2			0.500			SW846 - 8270
phenol	semivolatile	VPC			3.300	SW846 - 8270		SW846 - 8270
2-methylphenol	semivolatile	227			0.000	SW846 - 8270		SW846 - 8270
3-methylphenol	semivolatile	OII G			0.060	SW846 - 8270	0.01000	SW846 - 8270
4-methylphenol	ceminolatile	2				SW846 - 8270	0.01000	SW846 - 8270
2-chlorophenol	semirolanic	011			0.660	SW846 - 8270	0.01000	SW846 - 8270
2.4-dichlorophenol	semivolatile	00				SW846 - 8270	0.01000	SW846 - 8270
2.4.5-trichlorophenol	semivolatile	ou .				SW846 - 8270		SW846 - 8270
2.4.6-trichlorophenol	semivolatile	00			0.660	SW846 - 8270	0.01000	SW846 - 8270
pentachlorophenol	cominclatile	ШО				SW846 - 8270	0.01000	SW846 - 8270
2.4-dinitrophenol	semivolatile	no	0.0010	0		SW846 - 8270	0.05000	SW846 - 8270
bis(2-ethylhexyl)phthalate	semivolatile	OII	0,000	•		SW846 - 8270		SW846 - 8270
butylbenzylphthalate	semivolatile	S	0.0000	0		SW846 - 8270		SW846 - 8270
di-n-hutvinhthalate		21	00.1.0	0	0.060	SW846 - 8270	0.01000	SW846 - 8270
diethylphthalate	semivolatile	yes			099.0	SW846 - 8270	0.01000	SW846 - 8270
di mothil altilata	semivolatile	no		-	0.660	SW846 - 8270	0.01000	SW846 - 8270
di metnyi phthalate	semivolatile	no			0.660	SW846 - 8270		SW846 - 8270
ul-il-octyl pntnalate	semivolatile	no			0.660	SW846 - 8270		SW846 - 8270
Denzene	volatile	ou	0.0050	0	0.005	SW846 - 8240	0 00500	0/70 - 010 MS
						7	—i	0+70 - 0+0 M

TABLE 6 REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS

		Compound is	Maximum Maximum ContaminantContaminant	Maximum	Practical or Estimated Onantitation Limita	untitation Limite
Chemical	Compound	Considered	Level	Level Goal	Low Contaminated Soil	Groundwater
Name	Type Bio	Bioaccumulatable	(MCL)	(MCLG)	Value Method	Value Method
		(yes/no)	(mg/L)	(mg/L)	(mg/Kg)	(mg/L)
toluene	volatile	ou	1.0000	1.0000	0.005 SW846 - 8240	0.00500 SW846 - 8240
ethylbenzene	volatile	no	0.7000	0.7000	0.005 SW846 - 8240	0.00500 SW846 - 8240
xylenes	volatile	ou	10.0000	10.0000	0.005 SW846 - 8240	0.00500 SW846 - 8240
vinyl chloride	volatile	ou	0.0020	0	0.010 SW846 - 8240	0.01000 SW846 - 8240
chloroethane	volatile	по			0.010 SW846 - 8240	0.01000 SW846 - 8240
1,1-dichloroethylene	volatile	по	0.0070	0.0070	0.005 SW846 - 8240	0.00500 SW846 - 8240
1,1-dichloroethane	volatile	ОП			0.005 SW846 - 8240	0.00500 SW846 - 8240
1,2-dichloroethylene (cis)	volatile	ou	0.0700	0.0700	0.005 SW846 - 8240	0.00500 SW846 - 8240
1,2-dichloroethane	volatile	ou	0.0050	0	0.005 SW846 - 8240	0.00500 SW846 - 8240
trichloroethylene	volatile	Ou	0.0050	0	0.005 SW846 - 8240	0.00500 SW846 - 8240
1,1,1-trichloroethane	volatile	no	0.2000	0.2000	0.005 SW846 - 8240	0.00500 SW846 - 8240
1,1,2-trichloroethane	volatile	no	0.0050	0.0030	0.005 SW846 - 8240	0.00500 SW846 - 8240
tetrachloroethylene	volatile	00	0.0050	0	0.005 SW846 - 8240	0.00500 SW846 - 8240
1,1,1,2-tetrachloroethane	volatile	no			0.005 SW846 - 8240	0.00500 SW846 - 8240
1,1,2,2-tetrachloroethane	volatile	ou			0.005 SW846 - 8240	0.00500 SW846 - 8240
chloroform	volatile	ou	0.1000	0	0.005 SW846 - 8240	0.00500 SW846 - 8240
acetone	volatile	no			0.100 SW846 - 8240	0.10000 SW846 - 8240
4-methyl-2-pentanone	volatile	ou			0.050 SW846 - 8240	0.05000 SW846 - 8240
methyl ethyl ketone	volatile	Ou			0.100 SW846 - 8240	0.10000 SW846 - 8240
Aldrin	pest/herb/PCB	yes			0.003 SW846 - 8080	0.00004 SW846 - 8080
gamma-BHC (Lindane)	pest/herb/PCB	yes	0.0002	0.0002	0.006 SW846 - 8080	0.00009 SW846 - 8080
chlordane	pest/herb/PCB	yes	0.0020	0	0.009 SW846 - 8080	0.00014 SW846 - 8080
DDD	pest/herb/PCB	yes			0.007 SW846 - 8080	0.00011 SW846 - 8080
DDE	pest/herb/PCB	yes			0.003 SW846 - 8080	0.00004 SW846 - 8080
DDT	pest/herb/PCB	yes			0.008 SW846 - 8080	0.00012 SW846 - 8080
dieldrin	pest/herb/PCB	yes			0.001 SW846 - 8080	0.00002 SW846 - 8080
endosulfan sulfate	pest/herb/PCB	no			0.044 SW846 - 8080	0.00066 SW846 - 8080

TABLE 6 REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS

			Maximum	Maximum				
		Compound is	ContaminantContaminant	Contaminant	Practical	Practical or Estimated Quantitation Limits	ntitation Limi	îsî Î
Chemical	Compound	Considered	Level	Level Goal	Low Cont	Low Contaminated Soil	Grou	Groundwater
Name	Type Bioa	Bioaccumulatable	(MCL)	(MCLG)	Value	Method	Value	Method
		(yes/no)	(mg/L)	(mg/L)	(mg/Kg)		(mg/L)	
endrin	pest/herb/PCB	yes	0.0020	0.0020	0.004	0.004 SW846 - 8080	0.00006	0.00006 SW846 - 8080
heptachlor	pest/herb/PCB	yes	0.0004	0	0.00	0.002 SW846 - 8080	0.00003	0.00003 SW846 - 8080
heptachlor epoxide	pest/herb/PCB	00	0.0002	0	0.056	0.056 SW846 - 8080	0.00083	0.00083 SW846 - 8080
PCBs	pest/herb/PCB	yes	0.0005	0	0.044	0.044 SW846 - 8080	0.00065	0.00065 SW846 - 8080
lead	inorganic	OU	0.0150	0	0.500	0.500 SW846 - 7421	0.00300	0.00300 SW846-200.7
cadmium	inorganic	no	0.0050	0.0050	0.500	0.500 SW846 - 6010	0.00500	0.00500 SW846-200.7
silver	inorganic	no			1.000	1.000 SW846 - 6010	0.01000	SW846-200.7
mercury	inorganic	yes	0.0020	0.0020	0.100	0.100 SW846 - 7471	0.00020	0.00020 SW846-245.1
chromium vi	inorganic	OU	0.1000	0.1000	1.000	1.000 SW846 - 7196	0.01000	0.01000 SW846-7196
chromium iii	inorganic	ou	0.1000	0.1000	1.000	1.000 SW846 - 6010	0.01000	0.01000 SW846-200.7
barium	inorganic	no	2.0000	2.0000	20.000	20.000 SW846 - 6010	0.20000	0.20000 SW846-200.7
arsenic	inorganic	ou	0.0500		1.000	1.000 SW846 - 7060	0.01000	SW846-206.2
antimony	inorganic	no	0900.0	0900.0	6.000	6.000 SW846 - 7041	0.06000	0.06000 SW846-204.2
beryllium	inorganic	ou	0.0040	0.0040	0.500	0.500 SW846 - 6010	0.00500	0.00500 SW846-200.7
cyanide	inorganic	00	0.2000	0.2000	0.125	0.125 SW846 - 9012	0.01000	0.01000 SW846-335.3
nickel	inorganic	ou	0.1000	0.1000	4.000	4.000 SW846 - 6010	0.04000	SW846-200.7
selenium	inorganic	ou	0.0500	0.0500	0.500	0.500 SW846 - 7740	0.00500	SW846-270.2
vanadium	inorganic	no			5.000	5.000 SW846 - 6010	0.05000	SW846-200.7
zinc	inorganic	no			2.000	2.000 SW846 - 6010	0.02000	0.02000 SW846-200.7
NOTES.	C. C. Detoumenting	Land to the land of the land						

NOTES: a - Determined according to analytical methods summarized in Test Methods for Evaluating Solid Waste, EPA SW-846.

b - Determined according to Water Quality Criteria for Specific Substances, Ind. Reg. Vol 17, No. 7, April 1, 1993.

c - Practical quantitation limits based on Test Methods for Evaluating Solid Waste, EPA SW-846, 1986 for GC/MS methods. However, PQLs will change according to the specific analytical method used.

TABLE 7
SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

CHEMICAL PROPERTIES

DOSE-RESPONSE DATA

Chemical	Molecular Weight	Org Car Part-Koc	Oct Wat Part-Kow	Aqueous Solubility	Henry Law	Vapor Phase Diffus Coeff.	Referen	Reference Doses	Cancer S	Cancer Slope Factors
Хяще	[MW]	[KOC]	[KOW] (mg/L/mg/L)	(mg/L)	[H] (atm/mol)	[Di] (cm2/s)	Oral mg/kg/day	Inhalation mg/kg/day	Oral (mg/kg/day	Oral Inhalation (mg/kg/day (mg/kg/day)-1
naphthalene	128.20	1.28E+03	2.70E+03	31.7000	1.18E-03	5.90E-02	0.04000	i I		
acenaphthylene	152.21	4.79E+03	1.17E+04	3.9300	1.14E-04	6.60E-02				
acenaphthene	154.21	1.78E+01	1.33E+04	3.4200	7.71E-03	6.50E-02	0.06000			
fluorene	166.00	5.01E+03	1.69E+04	1.6900	1.17E-04	6.20E-02	0.04000			
phenanthrene	178.22	1.67E+04	2.68E+04	1.0000	6.05E-03	5.90E-02				
anthracene	178.23	2.17E+04	2.78E+04	0.0450	8.60E-05	5.90E-02	0.30000			
fluoranthene	202.00	4.17E+04	1.66E+05	0.2600	6.73E-02	5.60E-02	0.04000			
pyrene	202.30	6.90E+04	1.31E+05	0.1320	7.00E-09	5.50E-02	0.03000			
benzo(a)anthracene*	228.30	1.38E+06	6.41E+05	0.0140	1.38E-09	4.30E-02			0.7300	
chrysene*	228.20	2.45E+05	5.09E+05	0.0020	1.18E-09	5.10E-02			0.0073	
benzo(b)fluoranthene*	252.32	5.50E+05	3.72E+06	0.0015	1.19E-05	5.00E-02			0.7300	Man of a companied and a second as sec
benzo(k)fluoranthene*	252.32	4.37E+06	7.08E+06	0.0008	3.94E-05	4.70E-02		-	0.0730	
benzo(a)pyrene	252.30	8.81E+05	1.16E+06	0.0038	1.38E-09	4.30E-02			7.3000	6.1000
indeno(1,2,3-cd)pyrene*	276.34	3.09E+07	6.84E+06	0.0005	6.86E-08	4.60E-02		-	0.7300	
dibenzo(a,h)anthracene*	278.35	1.84E+06	3.20E+06	0.0005	7.33E-08	4.50E-02			7.3000	
benzo(g,h,i)perylene	276.34	7.76E+06	1.40E+07	0.0003	5.34E-08	4.80E-02				
3,3'-dichlorobenzidine	253.13	2.00E+03	3.24E+03	4.0000	8.33E-07	NA			0.4500	Manager Constitution of the Constitution of th
n-nitroso-di-n-propylamine	130.19	1.02E+01	2.04E+01	0000.0066	NA	NA	-		7.0000	Balanti Andria de Adella de de de Adella de de de contra en en esta en en el contra
bis(2-chloroisopropyl)ether	171.10	6.17E+01	3.80E+02	1700.0000	1.13E-04	6.02E-02	0.04000		0.0700	0.0350
4-chloroaniline	127.47	3.23E+02	2.02E+02	3.9000	1.07E-05	7.50E-02	0.00400			
2-chloronaphthalene	162.62	8.51E+03	1.17E+04	6.7400	1.82E-02	6.60E-02	0.08000			
2,4-dinitrotoluene	182.10	6.17E+01	9.55E+01	270.0000	4.07E-06	2.03E-01	0.00200			
hexachlorobutadiene	260.80	4.68E+03	6.03E+04	2.0000	4.57E+00	5.61E-02	0.00200		0.0780	0.0780
hexachloroethane	237.00	2.19E+03	1.10E+04	50.0000	2.49E-06	6.50E-02	0.00100		0.0142	0.0142
sophorone	138.21	3.09E+01	4.84E+01	12000.0000	5.76E-06	6.23E-02	0.20000		0.0010	
benzył alcohol	108.15	9.55E+01	1.26E+01	35000.0000	6.10E-07	7.90E-02	0.30000			
bis(2-chloroethyl)ether	143.00	1.41E+01	2.24E+01	10200.0000	1.30E-05	6.92E-02			1.1000	1.1000
		ניי ביי		000	100	400			. ,	

TABLE 7 SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

CHEMICAL PROPERTIES

DOSE-RESPONSE DATA

	1.04	(•						
Chemical	Molecular	Org Car Part-Koc	Oct Wat Part-Kow	Aqueous Solubility	Henry Law	Vapor Phase Diffus Coeff.	Reference Doses	c Doses	Cancer S	Cancer Slope Factors
Name	[MW]	[KOC]	IKOWI	laori	E	lal	Oral		Oral	Inhalation
1 A distinct	(K) 11000	(Link)	(mg/Llmg/L)	(mg/L)	(atm/mol)	(cm2/s)	mg/kg/day	mg/kg/day ((mg/kg/day	(mg/kg/day)-1
1,2-dichioropenzene	147.00	3.66E+02	2.78E+03	145.0000	1.94E-03	6.90E-02	0.09000			
1,3-dichlorobenzene	147.01	4.40E+02	3.00E+03	123.0000	3.61E-03	6.98E-02				
1,4-dichlorobenzene	147.00	2.09E+02	2.87E+03	79.0000	1.60E-03	6.90E-02		0.19999	0.0240	
1,2,4-trichlorobenzene	181.50	9.39E+02	1.20E+04	30.0000	1.42E-03	6.80E-02	0.01000			
hexachlorobenzene	284.80	4.55E+03	3.91E+05	0.0060	6.80E-04	5.42E-02	0.00080		1 6000	1 6000
hexachlorocyclopentadiene	272.77	4.27E+03	7.08E+04	1.8000	1.37E-02	5.61E-02	0.00700	0.00002		
n-nitrosodiphenylamine	198.23	5.75E+02	1.35E+03	34.7000	NA	9.70E-02			0.0049	-
benzoic acid	122.13	1.40E+02	7.90E+01	2700.0000	1.82E-08	7.40E-02	4.00000			
2-nitroaniline	138.14	2.66E+01	4.86E+01	1280.0000	5.00E-07	7.30E-02	0.00006	0.0006	-	
phenol	94.10	2.19E+01	2.95E+01	93000.0000	4.54E-07	8.20E-02	0.60000			
2-methylphenol	108.10	2.19E+01	9.05E+01	24660.0000	2.60E-06	7.40E-02	0.05000			
3-methylphenol	108.10	3.50E+01	9.33E+01	21928.0000	4.43E-07	7.40E-02				
4-methylphenol	108.10	1.57E+02	1.36E+02	19543.0000	4.43E-07	7.90E-02	0.05000	and the second second		
2-chlorophenol	128.60	3.63E+02	1.47E+02	28500.0000	1.78E-05	7.90E-02	0.00500			
2,4-dichlorophenol	163.01	7.00E+02	1.35E+03	4500.0000	4.80E-06	7.10E-02	0.00300			
2,4,5-trichlorophenol	197.45	1.74E+03	8.13E+03	1202.0000	2.18E-04	6.50E-02	0.10000			
2,4,6-trichlorophenol	197.46	7.19E+02	1.77E+03	800.0000	1.77E-05	6.60E-02			0.0110	0.0100
pentachlorophenol	266.40	2.63E+03	1.70E+05	14.0000	2.80E-06	5.60E-02	0.03000		0.1200	
2,4-dinitrophenol	184.00	1.78E+01	3.65E+01	5600.0000	1.53E-07	2.73E-02	0.00200	 		
bis(2-ethylhexyl)phthalate	391.07	1.00E+05	4.52E+04	0.4000	3.00E-07	3.51E-02	0.02000		0.0140	
buty ibenzy lphthalate	312.39	1.53E+02	4.24E+04	2.9000	1.08E-02	4.30E-02	0.20000); ;	
di-n-butylphthalate	278.30	1.38E+03	3.60E+04	13.0000	2.80E-07	4.38E-02	0.10000			
diethylphthalate	222.00	6.92E+01	1.96E+02	896.0000	1.11E-02	5.30E-02	0.80000			March - The Control of the Control o
di methyl phthalate	194.20	1.91E+02	4.70E+01	4320.0000	2.15E-06	5.68E-02	10.00000			
di-n-octyl phthalate	390.58	9.77E+08	1.58E+09	3.0000	1.37E-01	3.60E-02	0.02000			
penzene	78.10	7.91E+01	1.01E+02	1750.0000	5.50E-03	8.80E-02			00200	00000
toluene	92.40	1.62E+02	3.70E+02	535.0000	6.68E-03	8.70E-02	0.20000	0.11428	2	0.400
ethylbenzene	106.20	1.81E+02	1.29E+03	152.0000	6.44E-03	7.50E-02	0.10000	0.28571		

TABLE 7 SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

CHEMICAL PROPERTIES

DOSE-RESPONSE DATA

Chemical	Molecular Weight	Org Car Part-Koc	Oct Wat Part-Kow	Aqueous Solubility	Henry Law	Vapor Phase Diffus Coeff.	Referen	Reference Doses	Cancer	Cancer Slope Factors
Name	[MM]	[KOC]	[KOW]	SOL	Œ	<u>[a]</u>	Oral	Inhalation	Oral	Inhalation
	(g/g-mol)	(L/Kg)	(mg/L mg/L)	(mg/L)	(atm/mol)	(cm2/s)	mg/kg/day	mg/kg/day	(mg/kg/day	(mg/kg/day (mg/kg/day)-1
xylenes	106.20	3.32E+02	1.26E+03	198.0000	7.04E-03	7.47E-02	2.00000			
vinyl chloride	62.50	2.45E+00	3.98E+00	2670.0000	8.60E-02	1.06E-01			1.9000	0.3000
chloroethane	64.52	3.24E+00	2.69E+01	5740.0000	1.11E-02	2.71E-01		2.85700		
1,1-dichloroethylene	97.00	6.46E+01	6.38E+01	2250.0000	2.61E-02	1.00E-01	0.00900		0.6000	1.2000
1,1-dichloroethane	98.86	3.02E+01	6.10E+01	5500.0000	5.62E-03	9.60E-02	0.10000	0.10000		
1,2-dichloroethylene (cis)	96.95	4.90E+01	1.00E+00	3500.0000	4.08E-03	7.36E-02	0.01000			
1,2-dichloroethane	00'66	1.64E+01	2.92E+01	8520.0000	9.78E-04	1.04E-01	0.30000		0.0910	0.0910
trichloroethylene	131.40	9.63E+01	5.28E+02	1100.0000	9.58E-03	7.90E-02	0.00600		0.0110	0.0170
1,1,1-trichloroethane	133.40	1.42E+02	2.28E+02	1500.0000	1.72E-02	7.80E-02	0.09000	0.30000		
1,1,2-trichloroethane	133.40	6.87E+01	1.51E+02	4500.0000	7.42E-04	7.80E-02	0.00400		0.0570	0.0570
tetrachloroethylene	165.83	6.69E+01	3.37E+02	150.0000	2.87E-02	7.20E-02	0.01000		0.0510	0.0018
1,1,1,2-tetrachloroethane	168.00	3.99E+02	1.07E+03	1099.0000	2.00E-03	7.10E-02	0.03000		0.0260	0.0260
1,1,2,2-tetrachloroethane	168.00	7.55E+01	2.99E+02	2900.0000	3.80E-04	7.10E-02			0.2000	0.0200
chloroform	119.40	4.42E+01	8.71E+01	8200.0000	3.39E-03	1.04E-01	0.01000		0.0061	0.0805
acetone	58.00	3.72E-01	5.75E-01	10000000000	2.50E-05	1.24E-01	0.10000			to the second special special second to the second
4-methyl-2-pentanone	100.16	6.17E+00	1.23E+01	21300.0000	4.95E-05	7.50E-02	0.05000			
methyl ethyl ketone	72.10	1.23E+00	1.88E+00	137190.0000	4.35E-05	8.08E-02	0.05000	0.28570		
Aldrin	364.93	4.07E+02	2.82E+05	0.1800	4.96E-04	5.00E-02	0.00003		17.0000	17.1000
gamma-BHC (Lindane)	290.83	1.32E+03	4.09E+03	7.8000	4.93E-07	5.30E-02	0.00030		1.3000	
chlordane	410.00	2.29E+05	1.00E+06	0.0560	3.67E-05	4.80E-02	0.00006	a condition in	1.3000	1.2900
DDD	320.05	4.37E+04	4.90E+05	0.0900	3.89E-05	5.00E-02			0.2400	
DDE	318.03	4.93E+05	5.78E+05	0.0140	3.89E-05	4.90E-02	der ein dem dem der		0.3400	
DDT	354.49	3.13E+05	9.64E+05	0.0050	3.89E-05	4.70E-02	0.00050	e e e e e e e e e e e e e e e e e e e	0.3400	0.3400
dieldrin	380.93	2.07E+04	4.05E+04	0.1950	5.84E-05	NA	0.00005	to the same of the	16.0000	16.1000
endosulfan sulfate	422.90	2.34E+03	4.57E+03	0.1170	NA	NA	0.00005			
endrin	380.93	8.32E+03	3.69E+04	0.2600	NA	4.70E-02	0.00030			
heptachlor	373.35	2.19E+04	8.32E+04	0.1800	8.19E-04	5.10E-02	0.00050		4.5000	4.5500
hentachlor enoxide	389.20	2.09E+04	3.35E+04	0.3500	3.50E-01	AN	0.00001		9.1000	9 1000

TABLE 7 SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

			CHEMICAL	CHEMICAL PROPERTIES				DOSE-RESPONSE DATA	ONSE DATA	
	Molecular	Org Car	Oct Wat	Aqueous	Henry	Vapor Phase	Reference Doses	ce Doses	Cancer S	Cancer Slone Factors
Chemical	Weight	Part-Koc	Part-Kow	Solubility	Law	Diffus Coeff.				
	(form-j/a)		(me/I/me/I.)	(SOL)	(etm/mol)		Oral	Inhalation		Inhalation
PCBs	328.00	5.30E+05	1.10E+06	0.0031	1 07E-03	7	mg/ kg/uay	mg/kg/day (mg/kg/day		(mg/kg/day)-1
lead	207.19	NA	NA	NA	AN	1			0007.7	
cadmium	112.00	NA	AN	NA	AN	5.50E-02	0.00050			6 1000
silver	107.90	NA	NA	NA	NA	,	0.00500			0.100
mercury	200.59	NA	1.00	NA	1.14E-02	2.76	0.00030	00000		
chromium vi	52.00	NA	NA	NA	NA	L	0.00500	10000		41 0000
chromium iii	52.00	NA	NA	NA	NA	Ϋ́Z	1 00000			41.0000
barium	137.00	NA	NA	NA	NA	Y Z	0.07000			
arsenic	74.92	NA	NA	NA	NA	5.50E	0.00030			\$0,000
antimony	121.80	NA	NA	NA	NA	i	0.00040			0000
beryllium	9.01	NA	Ϋ́Ζ	0.2000	NA	Ϋ́	0.00500		4 3000	8 4000
cyanide	27.00	1.00E+00	\$.00E-01	1000000000000	2.70E-06	NA	0.02000			200
nickel	58.70	NA	NA	AN	NA	NA	0.02000			0.8400
selenium	78.96	NA	NA	AN	NA	AN	0.00500			
vanadium	51.00	NA	NA	AN	NA	NA	0.00700			
zinc	65.00	NA	NA	NA	NA	5.50E-02	0.30000			
OCHOIN								T		

NOTES: * - Assumes TEF approach.

NA - Data not available or not applicable.

TABLE 8
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER

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Chemical Name			:			
Name	Compound is	MCL or	Quantitation	Carcinogenic N	Carcinogenic Noncarcinogenic Groundwater	Groundwater
	Bioaccumulatable 1	Nonzero MCLG	Limit	Effects @10-5	Effects	Criteria
	(yes/no)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
naphthalene	ou		0.01000	NA	4.0880	4.0880
acenaphthylene	Ou		0.01000	NA	NA	NA
acenaphthene	ou		0.01000	NA	6.1320	6.1320
fluorene	ou ,		0.01000	NA	4.0880	4.0880
phenanthrene	ou		0.01000	NA	NA	NA
anthracene	ou		0.01000	AN	30.6600	30.6600
fluoranthene	yes		0.01000	NA	0.8176	0.8176
pyrene	ou		0.01000	AN	3.0660	3.0660
benzo(a)anthracene*	yes	0.0001	0.01000	0.0039	NA	0.0100
chrysene*	yes	200007	0.01000	0.3918	NA	0.3918
benzo(b)fluoranthene*	yes	0.0002	0.01000	0.0039	NA	0.0100
benzo(k)fluoranthene*	yes	0.0002	0.01000	0.0392	AN	0.0392
benzo(a)pyrene	yes	0.0002	0.01000	0.0004	AN	0.0100
indeno(1,2,3-cd)pyrene*	yes	0.0004	0.01000	0.0039	AN	0.0100
dibenzo(a,h)anthracene*	yes	0.0003	0.01000	0.0004	NA	0.0100
benzo(g,h,i)perylene	yes		0.01000	NA	NA	NA
3,3'-dichlorobenzidine	ou		0.02000	0.0064	ΑN	0.0200
n-nitroso-di-n-propylamine	ou		0.01000	0.0004	AN	0.0100
bis(2-chloroisopropyl)ether	ou		0.01000	0.0409	4.0880	0.0409
4-chloroaniline	0U		0.02000	NA	0.4088	0.4088
2-chloronaphthalene	ou		0.01000	NA	8.1760	8.1760
2,4-dinitrotoluene	ou		0.01000	NA	0.2044	0.2044
hexachlorobutadiene	yes		0.01000	0.0367	0.0409	0.0367
hexachloroethane	yes		0.01000	0.2014	0.0204	0.0204
isophorone	ou		0.01000	3.0105	20.4400	3.0105
benzyl alcohol	ou		0.02000	NA	30.6600	30.6600
bis(2-chloroethyl)ether	ou		0.01000	0.0026	NA	0.0100

TABLE 8
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER

CRITERIA FOR GROUNDWATER
NONRESIDENTIAL LAND USE SCENARIO

			Practical	Groundwater	dwater	
Chemical	Compound is	MCL or	Quantitation	Carcinogenic N	Carcinogenic Noncarcinogenic Groundwater	Groundwater
Name	Bioaccumulatable 1	Nonzero MCLG	Limit	Effects @10-5	Effects	Criteria
	(yes/no)	(mg/L)	(mg/L)	(mg/L)	(mo/L)	(ma/L)
nitrobenzene	ou		0.01000	NA	0.0511	0.0511
1,2-dichlorobenzene	ОП	0.6000	0.01000	NA	0.001	0.001
1,3-dichlorobenzene	ou	0.6000	0.01000	NA	NA	7.196U
1,4-dichlorobenzene	ou	0.0750	0.01000	0 1102	C N	VIII O
1,2,4-trichlorobenzene	поп	0 0 0 0	0.01000	0.1172	AN .	0.1192
hexachlorobenzene	JO L	0.000	0.01000	AN O	1.0220	1.0220
hexachlorocyclopentadiene	Ou	0.0000	0.01000	0.0018	0.0818	0.0100
n-nitrosodinhenvlamine		0.000	0.01000	AN	0.7154	0.7154
henzoic acid	по		0.01000	0.5837	NA	0.5837
2 mitroniline	no		0.05000	NA	408.8000	408.8000
z-titil Odillillic	no		0.05000	AN	0.0061	0.0500
7 2000	yes		0.01000	NA	12.2640	12.2640
2-methylphenol	OU.		0.01000	NA	5.1100	5 1100
3-memyiphenoi	00		0.01000	AN	AN	NA
4-metnyiphenoi	ou		0.01000	NA	\$ 1100	\$ 1100
2-cnlorophenol	ou		0.01000	NA	0.5110	0.5110
z,4-dichiorophenoi	ou		0.01000	NA	9908 0	0.2120
2,4,5-trichlorophenol	ОП		0.01000	AN	10 2200	0.2000
2,4,6-trichlorophenol	ou		0.01000	0.2600	NA	0.2200
pentachlorophenol	ou	0.0010	0.05000	0.0238	3.0660	0.2200
Lyt-unitionnemoi	no		0.05000	NA	0.2044	0.2044
bistyllengistations	yes	0900.0	0.01000	0.2043	0.4088	0.2043
dirihitylphihalate	ou	0.1000	0.01000	NA	20.4400	20.4400
diethylahtholoto	yes		0.01000	NA	2.0440	2.0440
di mother abttelete	no		0.01000	AN	81.7600	81 7600
di memyi phulalate	no		0.01000	NA	1022.0000	1022 0000
herzene	no		0.01000	NA	2.0440	2.0440
nelizelle	no	0.0050	0.00500	0.0986	NA	0.0986
					1	2,2,2

CRITERIA FOR GROUNDWATER
NONRESIDENTIAL LAND USE SCENARIO TABLE 8
SUMMARY OF HEALTH-BASED

			Practical	Groundwater	lwater	
Chemical	Compound is	MCL or	Quantitation	Carcinogenic N	Carcinogenic Noncarcinogenic Groundwater	Groundwater
Name	Bioaccumulatable 1	Nonzero MCLG	Limit	Effects @10-5	Effects	Criteria
	(yes/no)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
toluene	ou	1.0000	0.00500	NA	20.4400	20.4400
ethylbenzene	ou	0.7000	0.00500	NA	10.2200	10.2200
xylenes	ou	10.000	0.00500	NA	204.4000	204.4000
vinyl chloride	ou	0.0020	0.01000	0.0015	NA	0.0100
chloroethane	ou		0.01000	NA	NA	NA
1,1-dichloroethylene	ou	0.0070	0.00500	0.0048	0.9198	0.0070
1,1-dichloroethane	ou		0.00500	NA .	10.2200	10.2200
1,2-dichloroethylene (cis)	ou	0.0700	0.00500	NA	1.0220	1.0220
1,2-dichloroethane	ou	0.0050	0.00500	0.0314	30.6600	0.0314
trichloroethylene	OU	0.0050	0.00500	0.2600	0.6132	0.2600
1,1,1-trichloroethane	ou	0.2000	0.00500	NA	9.1980	9.1980
1,1,2-trichloroethane	ou	0.0050	0.00500	0.0502	0.4088	0.0502
tetrachloroethylene	ou	0.0050	0.00500	0.0561	1.0220	0.0561
1,1,1,2-tetrachloroethane	ou		0.00500	0.1100	3.0660	0.1100
1,1,2,2-tetrachloroethane	ou		0.00500	0.0143	NA	0.0143
chloroform	ou	0.1000	0.00500	0.4689	1.0220	0.4689
acetone	no		0.10000	NA	10.2200	10.2200
4-methyl-2-pentanone	ou		0.05000	NA	5.1100	5.1100
methyl ethyl ketone	no		0.10000	NA	5.1100	5.1100
Aldrin	yes		0.00004	0.0002	9000'0	0.0002
gamma-BHC (Lindane)	yes	0.0002	0.0000	0.0022	0.0061	0.0022
chlordane	yes	0.0020	0.00014	0.0022	0.0012	0.0020
DDD	yes		0.00011	0.0119	NA	0.0119
DDE	yes		0.00004	0.0084	NA	0.0084
DDT	yes		0.00012	0.0084	0.0102	0.0084
dieldrin	yes		0.00002	0.0002	0.0010	0.0002
endosulfan sulfate	ou		99000'0	NA	0.0051	0.0051
The second control of				The same of the sa	A SALAMBATAN CONTRACTOR OF STREET, STR	The state of the s

CRITERIA FOR GROUNDWATER SUMMARY OF HEALTH-BASED TABLE 8

NONRESIDENTIAL LAND USE SCENARIO

			Practical	Groundwater	lwater	
Chemical	Compound is	MCL or	Quantitation	Carcinogenic N	Carcinogenic Noncarcinogenic Groundwater	Groundwater
Name	Bioaccumulatable 1	Nonzero MCLG	Limit	Effects @10-5	Effects	Criteria
	(yes/no)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
endrin	yes	0.0020	900000	AN	0.0061	0.0061
heptachlor	yes	0.0004	0.00003	90000	0.0102	0.0006
heptachlor epoxide	ou	0.0002	0.00083	0.0003	0.0013	0.0008
PCBs	yes	0.0005	0.00065	0.0004	NA	0.0007
lead	ou	0.0150	0.00300	NA	NA AN	NA
cadmium	ОП	0.0050	0.00500	NA	0.0511	0.0511
silver	ou		0.01000	NA	0.5110	0.5110
mercury	yes	0.0020	0.00020	NA	0.0061	0.0061
chromium vi	ou	0.1000	0.01000	NA	0.5110	0.5110
chromium iii	ОИ	0.1000	0.01000	NA	102.2000	102.2000
barium	ОП	2.0000	0.20000	NA	7.1540	7.1540
arsenic	ОП	0.0500	0.01000	NA	0.0307	0.0500
antimony	ou	0900'0	0.06000	AN	0.0409	0.0600
beryllium	ou	0.0040	0.00500	0.0007	0.5110	0.0050
cyanide	ou	0.2000	0.01000	NA	2.0440	2.0440
nickel	ОП	0.1000	0.04000	NA	2.0440	2.0440
selenium	ou	0.0500	0.00500	NA	0.5110	0.5110
vanadium	υu		0.05000	NA	0.7154	0.7154
Zinc	Ou		0.02000	NA	30.6600	30.6600

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993. b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
NONRESIDENTIAL LAND USE SCENARIO

		Fractical	Surface Solls	e Solis	
Chemical	Compound is Bioaccumulatable	Quantitation Limit	Carcinogenic Effects @10-5	Noncarcinogenic Effects	Surface Soil Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
nanhthalene	no	0.660	NA	81,600.00	10,000.00
acenanhthviene	no	0.660	NA	NA	NA
acenaphthene	ОП	0990	NA	122,400.00	10,000.00
fliorene	OU	0.660	NA	81,600.00	10,000.00
phenanthrene	no	0990	NA	NA	NA
anthracene	OU	0990	NA	612,000.00	10,000.00
flioranthene	yes	0.660	AN	16,320.00	10,000.00
nvrene	OU	0.660	NA	61,200.00	10,000.00
henzo(a)anthracene*	yes	0.660	79.45	NA	79.45
chrysene*	yes	0.660	7,945.21	NA	7,945.21
henzo(h)fluoranthene*	yes	099.0	79.45	NA	79.45
henzo(k)fluoranthene*	yes	099.0	794.52	AN	794.52
henzo(a)pyrene	yes	0.660	7.94	NA	7.94
indeno(1.2.3-cd)pyrene*	yes	0.660	79.45	NA	79.45
dibenzo(a.h)anthracene*	yes	0.660	7.95	NA	7.95
benzo(g.h.i)pervlene	yes	099'0	NA	NA	NA
3.3'-dichlorobenzidine	Ou	1.300	128.89	AN	128.89
n-nitroso-di-n-propylamine	ou	099.0	8.29	NA	8.29
bis(2-chloroisopropyl)ether	ou	099.0	93.12	81,600.00	93.12
4-chloroaniline	ou	1.300	NA	8,160.00	8,160.00
2-chloronaphthalene	ou	099.0	NA	163,200.00	10,000.00
2.4-dinitrotoluene	ou	099.0	NA	4,080.00	4,080.00
hexachlorobutadiene	yes	099.0	1.78	816.00	1.78
hexachloroethane	yes	099.0	2,898.99	408.00	408.00
isophorone	ou	099.0	61,052.63	408,000.00	10,000.00
benzyl alcohol	ou	1.300	NA	612,000.00	10,000.00
bis(2-chloroethyl)ether	ou	099.0	4.06	NA	4.06

SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
NONRESIDENTIAL LAND USE SCENARIO

		Practical	Surfac	Surface Soils	
Chemical Name	Compound is Bioaccumulatable	Quantitation Limit	Carcinogenic Effects @10-5	Noncarcinogenic Effects	Surface Soil Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
nitrobenzene	ou	0.660	NA	1,020.00	1.020.00
1,2-dichlorobenzene	ОП	0.660	NA	183,600.00	10.000.00
1,3-dichlorobenzene	ou	0.660	NA	NA	NA
1,4-dichlorobenzene	ou	0.660	2,416.67	11,788.20	2,416.67
1,2,4-trichlorobenzene	ou	0.660	NA	20,400.00	10,000.00
hexachlorobenzene	ОП	099.0	6.87	1,632.00	6.87
hexachlorocyclopentadiene	ОП	0.660	NA	2.02	2.02
n-nitrosodiphenylamine	ou	099.0	11,836.73	NA	10.000.00
benzoic acid	ou	3.300	NA	8,160,000.00	10.000.00
2-nitroaniline	ОП	3.300	NA	42.90	42.90
phenol	yes	099.0	NA	244.800.00	10.000.00
2-methylphenol	ou	0.660	NA	102,000.00	10,000.00
3-methylphenol	ou	099.0	NA	NA	NA
4-methylphenol	ou	099.0	NA	102,000.00	10.000.00
2-chlorophenol	ou	0.000	NA	10,200.00	10,000.00
2,4-dichlorophenol	ou	099.0	NA	6,120.00	6,120.00
2,4,5-trichlorophenol	ou	099:0	NA	204,000.00	10,000.00
2,4,6-trichlorophenol	ou	0.660	1,922.89	NA	1.922.89
pentachlorophenol	ou	3.300	483.33	61,200.00	483.33
2,4-dinitrophenol	ou	3.300	NA	4,080.00	4,080.00
bis(2-ethylhexyl)phthalate	yes	0.660	4,142.86	8,160.00	4,142.86
butylbenzylphthalate	ou	0.660	NA	408,000.00	10,000.00
di-n-butylphthalate	yes	0.660	NA	40,800.00	10,000.00
diethylphthalate	OU	099.0	NA	1,632,000.00	10,000.00
di methyl phthalate	ou	099.0	NA	20,400,000.00	10,000.00
di-n-octyl phthalate	OU	099'0	NA	40,800.00	10,000.00
benzene	no	0.005	16.63	NA	16.63

TABLE 9
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
NONRESIDENTIAL LAND USE SCENARIO

973.47 1,000.00 1,000.00 1,000.00 0.15 1,000.00 24.97 00.000,1 22.74 101.23 ,000.00 1,000.00 44.62 24.48 241.67 70.59 ,000.00 ,000.00 0.27 53.01 75.91 75.41 Surface Soil Criteria (mg/Kg) 12.24 122.40 24.48 204.00 20.40 2,580.36 973.47 612,000.00 18,360.00 20,400.00 12,240.00 8,160.00 7,180.32 4,080,000.00 20,400.00 61,200.00 20,400.00 102,000.00 2,552.81 3,998.01 204,000.00 6,726.27 X Ϋ́ Noncarcinogenic Ϋ́ Ϋ́Z (mg/Kg) Surface Soils 0.15 170.59 5.27 24.97 22.74 101.23 5.28 44.62 39.45 241.67 75.41 0.27 75.91 153.01 Ϋ́ Ϋ́ Ν Ϋ́Z Ϋ́ Ϋ́ ٧ Carcinogenic Effects @10-5 (mg/Kg) Quantitation Practical (mg/Kg) Limit 0.005 0.005 0.010 0.010 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.100 0.050 0.100 0.003 900.0 0.000 0.008 0.007 Bioaccumulatable Compound is (yes/no) yes 00 yes 00 no 2 20 yes yes yes yes yes no 2 20 90 20 2 2-dichloroethylene (cis) ,1,2-tetrachloroethane I,2,2-tetrachloroethane Chemical gamma-BHC (Lindane) Name 4-methyl-2-pentanone ,1-dichloroethylene ,1,1-trichloroethane ,1,2-trichloroethane methyl ethyl ketone etrachloroethylene ,1-dichloroethane 2-dichloroethane endosulfan sulfate richloroethylene vinyl chloride ethylbenzene chloroethane chloroform chlordane acetone dieldrin xylenes Aldrin DDD DDE DDT

CRITERIA FOR SURFACE SOILS SUMMARY OF HEALTH-BASED TABLE 9

NONRESIDENTIAL LAND USE SCENARIO

		Practical	Surface Soils	e Soils	
Chemical	Compound is	Quantitation	Carcinogenic	Noncarcinogenic	Surface Soil
Name	Bioaccumulatable "	Limit ^B	Effects @10-5	Effects	Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
endrin	yes	0.004	NA	122.40	122.40
heptachlor	yes	0.002	4.16	204.00	4 16
heptachlor epoxide	no	0.056	6.37	26.52	6.37
PCBs	yes	0.044	7.53	AN	7.53
lead	ou	0.500	NA	NA	NA
cadmium	ou	0.500	NA	1,020.00	1.020.00
silver	ou	1.000	NA	10,200.00	10,000.00
mercury	yes	0.100	NA	122.40	122.40
chromium vi	ou	1.000	NA	10,200.00	10.000.00
chromium iii	no	1.000	NA	2,040,000.00	10.000.00
barium	ou	20.000	NA	142,800.00	10,000.00
arsenic	ou	1.000	NA	612.00	612.00
antimony	Ou	000'9	NA	816.00	816.00
beryllium	Ou	0.500	13.49	10,200.00	13.49
cyanide	ou	0.125	NA	40,800.00	1.000.00
nickel	ou	4.000	NA	40,800.00	10.000.00
selenium	ou	0.500	NA	10,200.00	10.000.00
vanadium	ou	5.000	NA	14,280.00	10.000.00
zinc	ou	2.000	NA	612,000.00	10 000 00
NOTES	C. o Commonade that are seen	1 to 1 to 1 to 1		7	20.000

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993. b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

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CRITERIA FOR SUBSURFACE SOILS
NONRESIDENTIAL LAND USE SCENARIO TABLE 10 SUMMARY OF HEALTH-BASED

		Practical	Subsurface Soils	ice Soils	Leaching to	Leaching to Groundwater	
Chemical	Compound is	Ouantitation	Carcinogenic N	Carcinogenic Noncarcinogenic	Groundwater	Subsurface	Subsurface
Name	Bioaccumulatable "	Limit b	Effects @10-5	Effects	Criteria	Soil Criteria	Soil Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(mg/Kg)	(mg/Kg)
nanhthalene	ou	099'0	NA	58,400.00	4.0880	10,534.54	10,000.00
scenanhthvlene	no	099'0	A'N	NA	NA	NA	NA
accinapitations	0U	0.660	NA	87,600.00	6.1320	65,215.08	10,000.00
fluorene	no	0.660	NA	58,400.00	4.0880	52,850.39	10,000.00
nhenanthrene	u u	099'0	NA	AN	NA	AN	AN
puthracene	0U	099'0	NA	438,000.00	30.6600	7,585,812.53	10,000.00
fluoranthene	yes	099'0	NA	11,680.00	0.8176	13,782.92	10,000.00
nucleur	OU	099'0	NA	43,800.00	3.0660	140,591.20	10,000.00
Pylotic henzo(a)anthracene*	ves	0.660	698.63	AN	0.0100	103.88	103.88
chrysene*	yes	0.660	69,863.01	NA	0.3918	67,777.62	10,000.00
henzo(h)fluoranthene*	yes	0.660	. 698.63	NA	0.0100	354.98	354.98
benzo(k)fluoranthene*	yes	099'0	6,986.30	NA	0.0392	3,759.12	3,759.12
henzo(a)nvrene	yes	0.660	69.85	AN	0.0100	212.87	69.85
indeno(1 2 3-cd)nyrene*	yes	0.660	698.63	NA	0.0100	629.17	629.17
dibenzo(a h)anthracene*	yes	0.660	98.69	NA	0.0100	649.66	98.69
henzo(o h i)nerviene	yes	0.660	AN	NA	NA	AN	Ϋ́
3 3'-dichlorohenzidine	u	1.300	1,133.33	NA	0.0200	12.86	12.86
n-nitroso-di-n-propylamine	no	0.660	72.86	NA	0.0100	90.0	99.0
bis(2-chloroisopropyl)ether	no	099'0	1,472.23	58,400.00	0.0409	1.32	1.32
4-chloroaniline	0U	1.300	AN	5,840.00	0.4088	1,117.69	1,117.69
2-chloronaphthalene	ou	0.660	NA	116,800.00	8.1760	68,632.75	10,000.00
2 4-dinitrotoluene	ou	0.660	NA	2,920.00	0.2044	39.07	39.07
hexachlorobutadiene	yes	099'0	31.18	584.00	0.0367	46.06	31.18
hexachloroethane	yes	0.660	29,818.48	292.00	0.0204	3.31	3.31
isophorone	no	099'0	536,842.11	292,000.00	3.0105	256.03	256.03
benzyl alcohol	no	1.300	NA	438,000.00	30.6600	4,356.75	4,356.75
bis(2-chloroethyl)ether	no	099.0	66.24	NA	0.0100	90.0	99.0

CRITERIA FOR SUBSURFACE SOILS NONRESIDENTIAL LAND USE SCENARIO TABLE 10 SUMMARY OF HEALTH-BASED

Chemical		Onentitotion					
Z	Compound is		Carcinogenic	Carcinogenic Noncarcinogenic	Groundwater	Subsurface	Subsurface
	Bioaccumulatable 1	Limit ^b	Effects @10-5	Effects	Criteria	Soil Criteria	Soil Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(me/Ke)	(mø/Kø)
nitrobenzene	ou	0.660	NA	730.00	0.0511	1.73	1.73
1,2-dichlorobenzene	ОП	0.660	NA	131,400.00	9.1980	15.093.56	10 000 00
1,3-dichlorobenzene	no	099'0	NA	NA	Ϋ́	AN	AN
1,4-dichlorobenzene	ou	099'0	21,250.00	16,873.31	0.1192	34.67	34.67
1,2,4-trichlorobenzene	ou	0.660	NA	14,600.00	1.0220	1.405.37	1 405 37
hexachlorobenzene	no	099.0	101.56	1,168.00	0.0100	165.57	101 56
hexachlorocyclopentadiene	ou	0.660	AN	2.89	0.7154	3.904.08	2.89
n-nitrosodiphenylamine	00	0.660	104,081.63	NA	0.5837	567.80	567.80
benzoic acid	ou	3.300	NA	5,840,000.00	408.8000	813.796.56	10,000,00
2-nitroaniline	ou	3.300	NA	45.47	0.0500	2.08	3.30
phenol	yes	0.660	, NA	175,200.00	12.2640	658.78	658.78
2-methylphenol	ou	0.660	Ϋ́N	73,000.00	5.1100	375.93	375 93
3-methylphenol	ou	0.660	AZ	NA	YZ.	ΑN	AN
4-methylphenol	ou	0.660	Ϋ́Α	73,000.00	5.1100	427.24	407.74
2-chlorophenol	ou	0.660	AN	7,300.00	0.5110	11.63	11.63
2,4-dichlorophenol	ou	0.660	NA	4,380.00	0.3066	15.12	15.12
2,4,5-trichlorophenol	ou	0.660	NA	146,000.00	10.2200	5.507.44	5 507 44
2,4,6-trichlorophenol	ou	099'0	24,779.61	ΑN	0.2600	30.65	30.65
pentachlorophenol	Ou	3.300	4,250.00	43,800.00	0.0500	24.95	24.95
2,4-dinitrophenol	ou	3.300	AN	2,920.00	0.2044	7.37	7.37
bis(2-ethylhexyl)phthalate	yes	099.0	36,428.57	5,840.00	0.2043	1,406.25	1.406.25
butylbenzylphthalate	ou	0.660	NA	292,000.00	20.4400	421,659.24	10.000.00
di-n-butylphthalate	yes	0.660	NA	29,200.00	2.0440	6.188.56	6.188.56
diethylphthalate	ou	099.0	NA	1,168,000.00	81.7600	139.039.43	10,000,00
di methyl phthalate	0U	099'0	NA	14,600,000.00	1022.0000	2,427,459,10	10.000.00
di-n-octyl phthalate	ou	0.660	NA	29,200.00	2.0440	13,865.50	10,000.00
benzene	0u	0.005	289.96	NA	0.0986	4.77	4 77

CRITERIA FOR SUBSURFACE SOILS NONRESIDENTIAL LAND USE SCENARIO SUMMARY OF HEALTH-BASED TABLE 10

		Practical	Subsurface Soils	ace Soils	Leaching to Groundwater	Groundwater	
Chemical	Compound is	Quantitation	Carcinogenic N	Carcinogenic Noncarcinogenic	Groundwater	Subsurface	Subsurface
Name	Bioaccumulatable .	Limit b	Effects @10-5	Effects	Criteria	Soil Criteria	Soil Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(mg/Kg)	(mg/Kg)
tolnene	ou	0.005	NA	3,631.30	20.4400	23,897.46	1,000.00
athylhanzana	no	0.005	NA	9,928.27	10.2200	17,179.71	1,000.00
xvlenes	no	0.005	AN	2,920,000.00	204.4000	1,232,453.05	1,000.00
vinvl chloride	no	0.010	0.30	NA	0.0100	0.13	0.13
chloroethane	no	0.010	NA	3,693.46	NA	NA	1,000.00
1 1-dichloroethylene	no	0.005	2.59	13,140.00	0.0070	80.0	0.08
1 1-dichloroethane	no	0.005	NA	1,386.78	10.2200	2,385.62	1,000.00
1 2-dichloroethylene (cis)	no	0.005	AN	14,600.00	1.0220	102.49	102.49
1 2-dichloroethane	0u	0.005	96.16	438,000.00	0.0314	0.37	0.37
trichloroethylene	0u	0.005	437.11	8,760.00	0.2600	25.73	25.73
1.1.1-trichloroethane	ou	0.005	, NA	5,600.68	9.1980	4,173.92	1,000.00
1.1.2-trichloroethane	u	0.005	391.20	5,840.00	0.0502	1.05	1.05
tetrachloroethylene	u	0.005	1,634.72	14,600.00	0.0561	8.01	8.01
1.1.2-tetrachloroethane	no	0.005	1,291.02	43,800.00	0.1100	7.24	7.24
1.1.2.2-tetrachloroethane	n0	0.005	1,052.52	NA	0.0143	0.21	0.21
chloroform	no	0.005	92.76	14,600.00	0.4689	20.33	20.33
acetone	n0	0.100	AN	146,000.00	10.2200	136.29	136.29
4-methyl-2-pentanone	no	0.050	AN	73,000.00	5.1100	407.48	407.48
methyl ethyl ketone	0U	00100	AN	9,032.18	5.1100	146.24	146.24
Aldrin	yes	0.003	4.35	8.76	0.0002	90.0	90.0
gamma-BHC (Lindane)	yes	0.006	392.31	87.60	0.0022	0.34	0.34
chlordane	yes	0.009	368.21	17.52	0.0020	4.51	4.51
DDD	yes	0.007	2,125.00	NA	0.0119	48.34	48.34
DDE	yes	0.003	1,500.00	AN	0.0084	80.49	80.49
DDT	yes	0.008	1,418.50	146.00	0.0084	141.83	141.83
dieldrin	yes	0.001	31.88	14.60	0.0002	90.0	90.0
endosulfan sulfate	0u	0.044	AN	73.00	0.0051	12.00	12.00

TABLE 10 SUMMARY OF HEALTH-BASED CRITERIA FOR SUBSURFACE SOILS

NONRESIDENTIAL LAND USE SCENARIO

Š		Practical	Subsurf	Subsurface Soils	Leaching to	Leaching to Groundwater	
Chemical	Compound is Bioaccumulatable	Quantitation Limit	Carcinogenic Effects @10-5	Carcinogenic Noncarcinogenic Effects @10-5	Groundwater	Subsurface	Subsurface
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(mo/Ke)	(mo/Ka)
endrin	yes	0.004	AN	87.60	0.0061	10.12	1010
heptachlor	yes	0.002	55.28	146.00	0 0006	0.44	10.12
heptachlor epoxide	no	0.056	56.04	18.98	0.0008	0.45	0.44
PCBs	yes	0.044	66.23	NA	0.0007	4.23	4.23
lead	no	0.500	NA	NA	AN	NA	AN
cadmium	по	0.500	NA	730.00	0.0511	NA	730 00
silver	no	1.000	NA	7,300.00	0.5110	AN	7 300 00
mercury	yes	0.100	NA	87.60	0.0061	AN	87.60
chromium vi	no	1.000	NA	7,300.00	0.5110	AN	7 300 00
chromium iii	u	1.000	NA	1,460,000.00	102.2000	A'A	10 000 00
barium	no	20.000	NA	102,200.00	7.1540	AN	10,000,00
arsenic	no	1.000	NA	438.00	0.0500	AN AN	438.00
antimony	no	9.000	AN	584.00	0.0600	Y Y	584 00
beryllium	00	0.500	118.60	7,300.00	0.0050	Ϋ́Z	118 60
cyanide	ou	0.125	NA	29,200.00	2.0440	AN	10 000 00
nickel	ou	4.000	Ϋ́N	29,200.00	2.0440	AN	10 000 00
selenium	no	0.500	NA	7.300.00	0.5110	ΔN	7 300 00
vanadium	no	5.000	NA	10,220.00	0.7154	AN	10,000,000
Zinc	no	2.000	NA	438,000.00	30.6600	×	10,000,00
SHON	NOTES: 3 - Community that are accumed to be bigg	med to be biggeries				-	2000

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

TABLE 11
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER
RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable	MCL or Nonzero MCLG	Quantitation Limit	Carcinogenic Effects @10-6	Noncarcinogenic Effects	Groundwater Criteria
	(yes/no)	(7/8m)	0.01000	NA	1 21600	1.21600
naphthalene	ШО		0.010.0	YIV.	VN	AN
acenaphthylene	00		0.01000	VVI	UNI .	00700
acenaphthene	ou		0.01000	NA	1.82400	1.82400
lineana	ou		0.01000	AN	1.21600	1.21600
inolene	92		0.01000	AN	NA	NA
pnenantmene	OE		0.01000	NA	9.12000	9.12000
antinacene	Ser.		0.01000	NA	0.24320	0.24320
nuorannene			0.01000	NA	0.91200	0.91200
pyrene	OII	0100010	0.01000	0.00012	NA	0.00010
benzo(a)antinacene	Sol.	0.00020	0.01000	0.01164	NA	0.00020
chrysene-) yes	0.00020	. 0.01000	0.00012	NA	0.00020
penzo(o)(luorantirene	SAV	0.00020	0.01000	0.00116	AN	0.00020
benzo(k)iluoianinene	ves	0.00020	0.01000	0.00001	NA	0.00020
Circlapyienc	ves	0.00040	0.01000	0.00012	NA	0.00040
dikanzo(a h)anthracene*	ves	0.00030	0.01000	0.00001	NA	0.00030
diction and an income	Say		0.01000	NA	NA	NA
Delizo(g,ii,i)peryletie	OL		0.02000	0.00019	NA	0.02000
3,3 -ulcinolocalization	Ou		0.01000	0.00001	NA	0.01000
his/2 chloroisonronyllether	00		0.01000	0.00042	1.21600	0.01000
4 oblomaniline	00		0.02000	NA	0.12160	0.12160
7-chloronanhthalene	UU		0.01000	NA	2.43200	
2 4-dinitrotolijene	ou		0.01000	NA	08090'0	0.06080
Ly Commercial Commerci	ves		0.01000	0.00109	0.01216	0.01000
hevochloroethane	Ves		0.01000	0.00599	0.00608	0.01000
iconhorone	u u	-	0.01000	0.08947	00080.9	0.08947
hourst alcohol	OL		0.02000	AN	9.12000	9.12000
bis(2-chloroethyllether	no		0.01000	0.00002	NA	0.01000
Vista Cindi Octin) () Cindi			0.010.0	47	0.01520	0.01520

TABLE 11
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER
RESIDENTIAL LAND USE SCENARIO

Chemical			Practical	Groun	Groundwater	
Лаше	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Quantitation Limit b (mo/L)	Carcinogenic Effects @10-6	Noncarcinogenic Effects	Groundwater Criteria
1,2-dichlorobenzene	0u	0.60000	0.01000	NA	7 73600	(mg/L)
I,3-dichlorobenzene	ou	0.60000	0.01000	VIV.	717	0.0000
1,4-dichlorobenzene	011	0.07500	0.01000	730000	AN .	0.60000
2,4-trichlorobenzene	00	000000	0.010.0	0.00334	C7170'1	0.07500
hexachlorobenzene	Ou .	0.00100	0.01000	AN .	0.30400	0.0200
hexachlorocyclopentadiana		0.00100	0.01000	0.00005	0.02432	0.00100
nevacino ocyclopemanicine	no	0.05000	0.01000	NA	0.21280	0.05000
-iniosouphenylamine	no		0.01000	0.01735	NA	0.01735
Denzoic acid	no no		0.05000	NA	121.60000	121.60000
2-nitroaniline	ou		0.05000	NA	0.00182	0.05000
phenoi	yes		0.01000	NA	3.64800	3 64800
2-methylphenol	no		0.01000	NA	1.52000	1 52000
3-methy[phenol	no		0.01000	N.	NA	AM
4-methylphenol	no		0.01000	N.	1 52000	1 \$2000
2-chlorophenol	no		0.01000	AN	0 15200	0.15200
2,4-dichlorophenol	ou		0.01000	NA	00100	0.1000
2,4,5-trichlorophenol	no		0.01000	₹N	3.04000	0.09120
2,4,6-trichlorophenol	0U		0.01000	0.00175	AIN	3.04000
pentachlorophenol	ou	0.00100	0.05000	120000	WI	0.01000
2,4-dinitrophenol	ou		0.05000	1/000.0	0.91200	0.00100
bis(2-ethylhexyl)phthalate	New	0 0000	00000	AVI	0.06080	0.06080
butylbenzylphthalate	no	0.0000	0.01000	0.00607	0.12160	0.00600
di-n-butylphthalate	Sey	0.10000	0.01000	NA	00080.9	0.10000
diethvlohthalate	33.		0.01000	NA	0.60800	0.60800
mother attended	no		0.01000	NA	24.32000	24.32000
di memyi phinalare	00		0.01000	NA	304.00000	304.00000
di-ii-ociyi pninalare	no		0.01000	NA	0.60800	0.60800
Denzene	no	0.00500	0.00500	0.00062	NA	0.00500
toluene	no	1.00000	0.00500	NA	0.80393	1.00000
etnyloenzene	no	0.70000	0.00500	AN.	1 31450	00000

TABLE 11
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER
RESIDENTIAL LAND USE SCENARIO

Chemical Name Name Name Name Name Name Name Name	Compound is Bioaccumulatable	MCL or	Quantitation	Carringenic	Noncercinogenic	Groundwater
xylenes vinyl chloride chloroethane 1,1-dichloroethane 1,2-dichloroethane trichloroethane trichloroethylene 1,1,1-trichloroethane trichloroethylene 1,1,1-trichloroethylene 1,1,2-trichloroethane tetrachloroethylene	(00/840)	Nonzero MCLG (mg/L)	Limit ° (mg/L)	Effects @10-6 (mg/L)	Effects (mg/L)	Criteria (mg/L)
vinyl chloride chloroethane 1,1-dichloroethylene 1,2-dichloroethylene 1,2-dichloroethylene trichloroethylene 1,1,1-trichloroethane 1,1,1-trichloroethane 1,1,2-trichloroethane tetrachloroethylene	ou ou	10.00000	0.00500	NA	60.80000	10.00000
chloroethane 1,1-dichloroethylene 1,2-dichloroethane 1,2-dichloroethane trichloroethylene 1,1,1-trichloroethane 1,1,1-trichloroethylene 1,1,1-trichloroethane trichloroethylene	92	0.00200	0.01000	0.00003	NA	0.00200
chloroethane 1,1-dichloroethylene 1,2-dichloroethane 1,2-dichloroethane trichloroethylene 1,1,1-trichloroethane 1,1,1-trichloroethylene 1,1,1-trichloroethylene tetrachloroethylene			0.01000	NA	23.16075	23.16075
1,1-dichloroethylene 1,1-dichloroethylene (cis) 1,2-dichloroethylene trichloroethylene 1,1,1-trichloroethane 1,1,1-trichloroethane tetrachloroethylene		0.00700	0.00500	0.00002	0.27360	0.00700
1,1-dichloroethane 1,2-dichloroethylene (cis) 1,2-dichloroethane trichloroethylene 1,1,1-trichloroethane 1,1,2-trichloroethylene tetrachloroethylene	2 2		0.00500	NA	0.64000	0.64000
1,2-dichloroethytene (Cis) 1,2-dichloroethane trichloroethylene 1,1,1-trichloroethane tti.1,2-trichloroethane tetrachloroethylene		0.07000	0.00500	AN	0.30400	0.07000
richloroethylene 1,1,1-trichloroethane 1,1,2-trichloroethane tetrachloroethylene		0.00500	0.00500	0.00020	9.12000	0.00500
trichloroethylene 1,1,1-trichloroethane 1,1,2-trichloroethane tetrachloroethylene		0.00500	0.00500	0.00114	0.18240	0.00500
1,1,1-trichloroethane 1,1,2-trichloroethane tetrachloroethylene		0.20000	0.00500	NA	1.28753	0.20000
1,1,2-trichloroethane tetrachloroethylene		00000	0.00500	0.00031	0.12160	0.00500
tetrachloroethylene	OII G	0.00500	0.00500	0.00147	0.30400	0.00500
	OII C		0.00500	000000	0.91200	0.00500
1,1,1,2-tetrachloroethane			0.00500	0.00031	NA	0.00500
1,1,2,2-tetrachioroethane	011	0.10000	0.00500	0.00028	0.30400	0.10000
chloroform	OII C		0.10000	NA	3.04000	3.04000
acetone			0.05000	NA	1.52000	1.52000
4-methyl-2-pentanone	21		0.1000	AN	0.91772	0.91772
methyl ethyl ketone	010		0.00004	0.00001	0.00018	0.00004
Aldrin	Yes	0.00020	0.0000	0.00007	0.00182	
gamma-BHC (Lindane)	SAN	0.00200	0.00014	0.00007	0.00036	0.00200
chlordane	VPC		0.00011	0.00035	NA	0.00035
DDD	CAT .		0.00004	0.00025	NA NA	0.00025
UDDE	SAN		0.00012	0.00025	0.00304	0.00025
IDDI	507		0.0002	0.00001	0.00030	0.00002
dieldrin	SS. S		0.00066	NA	0.00152	0.00152
endosulfan sulfate	OH	0.00200	0.00006	AN	0.00182	0.00200
endrin	Ves	0.00040	0.00003	0.00002	0.00304	0.00040
neprachior	25	0 00000	0.00083	0.00001	0.00040	0.00020

TABLE 11 SUMMARY OF HEALTH-BASED CRITERIA FOR GROUNDWATER

RESIDENTIAL LAND USE SCENARIO

			Practical	Groun	Groundwater	
Name	Compound is Bioaccumulatable (ves/no)	MCL or Nonzero MCLG (me/l.)	Quantitation Limit b	Carcinogenic Effects @10-6	Noncarcinogenic Effects	Groundwater Criteria
PCBs	yes	0.00050	0.00065	0.00001	(mg/L)	(mg/L)
lead	OU	0.01500	0.00300	Ϋ́	NA	4N
cadmium	no	0.00500	0.00500	NA	0.01520	00500
silver	ou no		0.01000	AN	0.15200	0.15200
mercury	yes	0.00200	0.00020	Ϋ́	0:00182	0 00000
chromium vi	ou 0	0.10000	0.01000	AN	0.15200	0 10000
chromium iii	no	0.10000	0.01000	A. A.	30.4000	0 10000
barium	ou	2.00000	0.20000	AN	2 12800	2 00000
arsenic	ou	0.05000	0.01000	N AN	0.00013	0.05000
antimony	no	0.00600	0.06000	AN	0.00212	0.00000
beryllium	υu	0.00400	0.00500	200000	0.15100	0.00000
cyanide	ou	0.20000	0.01000	NA	0.809.0	0.0000
nickel	no	0.10000	0.04000	AN	0.8000	0 10000
selenium	ou	0.05000	0.00500	NA	0 15200	0.05000
vanadium	ou		0.05000	AN	0.21280	0.00000
zinc	ОП	·	0.02000	AN	9 12000	0.21280
					00071.	

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
RESIDENTIAL LAND USE SCENARIO

		Practical	Surfac	Surface Soils	
	Compound is	Ouantitation	Carcinogenic	Noncarcinogenic	Surface Soil
Chemical	Bioaccumulatable *	Limit	Effects @10-6	Effects	Criteria
	(ves/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
	Ou Ou	0990	NA	10,800.00	10,000.00
naphthalene		0990	NA	NA	NA
acenaphthylene	OII	0.660	NA	16,200.00	10,000.00
acenaphthene	011	0.660	AN	10,800.00	10,000.00
fluorene	Ou Co	0.000	ΑN	NA	NA
phenanthrene	OII	0,660	NA	81,000.00	10,000.00
anthracene	OH NAN	0.660	NA	2,160.00	2,160.00
Tiuorantnene	Sa.	0990	AN	8,100.00	8,100.00
pyrene	Oll	0990	0.88	NA	0.88
benzo(a)anthracene-	554	, 0990	87.67	NA	87.67
chrysene"	Yes	0990	0.88	NA	0.88
benzo(b)fluoranthene	507	0990	8.77	NA	8.77
benzo(k)fluoranthene	201	0 660	0.00	NA	99'0
benzo(a)pyrene	Yes	0.660	0.88	NA	0.88
indeno(1,2,3-cd)pyrene	J CS	0990	0.00	NA	99.0
dibenzo(a,h)anthracene	Yes	099 0	NA	NA	ΥN
benzo(g,h,ı)perylene	S C C C C C C C C C C C C C C C C C C C	1.300	1.42	NA	1.42
3,3'-dichlorobenziaine	OH CH	0990	0.00	NA	
n-nitroso-di-n-propylanime	Cu	099.0	9.14	10,800.00	
	Ou	1.300	AN	1,080.00	
4-chioroanime	OE .	099'0	NA	21,600.00	10,000.00
2-chloronaphiliaiche	Qu	0.660	NA	540.00	54
2,4-dinitrololucile	Selv	0990	8.21	108.00	8.21
nexachiorobuladiene	SOL	0990	45.07	54.00	45.07
hexachioroethane	SOL OU	0990	673.68	54,000.00	673.68
Isophorone	OL C	1.300	NA	81,000.00	10,000.00
Denzyl alconol	Ou .	0.660	0.58	NA	99.0

CRITERIA FOR SURFACE SOILS
RESIDENTIAL LAND USE SCENARIO TABLE 12 SUMMARY OF HEALTH-BASED

Chemical Name nitrobenzene	Compound is	Quantitation	Carcinogenic	nic Noncarcinogenic	Surface Soil
	Diocessississississississississississississi	•) , 		TION AND THE
nitrobenzene	Bioaccumulatable	Limit	Effects @10-6	Effects	Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
1 7 1:11	no	0.660	NA	135.00	135.00
1,2-dichlorobenzene	по	0.660	NA	24,300,00	10.000.00
1,3-dichlorobenzene	no	099.0	NA	NA	NA
1,4-dichlorobenzene	no	0.660	26.67	NA	79 97
1,2,4-trichiorobenzene	no	0.660	NA	2.700.00	2 700 00
nexachlorobenzene	no	0.660	0.40	216.00	0.007,2
nexachiorocyclopentadiene	no	0.660	NA	1,890.00	1 890 00
n-nitrosodiphenylamine	no	0.660	130.61	NA	130 61
Delizoic acid	no	3.300	NA	1,080,000.00	10.000.00
z-nitroaniine	ou	3.300	NA	16.20	16.20
	yes	0.099.0	NA	32.400.00	10 000 00
2-metnylphenol	0u	0.660	AN	13,500.00	10,000,00
3-metnyiphenol	OU	0.660	NA	NA	NA
-metnyiphenol	по	0.660	NA	13 500 00	10 000 01
-chlorophenol	no	0.660	NA	1 350 00	1 350 00
2,4-dichlorophenol	no	0.660	NA	810.00	810.00
,4,5-trichlorophenol	ou	099.0	NA	27,000,00	10 000 00
2,4,6-trichlorophenol	ou	0.660	58.18	NA	58.18
ventachlorophenol	no	3.300	5.33	8,100.00	5 33
2,4-dinitrophenoi	no no	3.300	NA	540.00	540.00
bis(z-culyillexyl)phinalare	yes	0.660	45.71	1,080.00	45.71
in histilatekalata	no	099.0	NA	54,000.00	10,000.00
distrulational	yes	099.0	NA	5,400.00	5,400.00
di methyl abthalate	no	0.660	NA	216,000.00	10,000.00
di-n-octyl phthalate	ш	0.660	NA	2,700,000.00	10,000.00
henzene	no	0.660	NA	5,400.00	5,400.00
	no	0.005	22.07	AN	22 07

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TABLE 12 SUMMARY OF HEALTH-BASED CRITERIA FOR SURFACE SOILS

RESIDENTIAL LAND USE SCENARIO

		Practical	Surfa	Surface Soils	
Chemical	Compound is	Quantitation	Carcinogenic	Noncarcinogenic	Surface Soil
Лате	Bioaccumulatable (ves/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
tolinene	ou	0.005	NA	54,000.00	1,000.00
ethylhenzene	Ou	0.005	NA	27,000.00	1,000.00
xvlenes	ou	0.005	AN	540,000.00	1,000.00
vinvl chloride	ou	0.010	0.34	NA	0.34
chloroethane	ou	0.010	NA	NA	NA
1 1-dichloroethylene	ou	0.005	1.07	2,430.00	1.07
1 1-dichloroethane	ou	0.005	NA	27,000.00	1,000.00
1 2-dichloroethylene (cis)	no	0.005	NA	2,700.00	1,000.00
1 2-dichloroethane	ou	0.005	7.03	81,000.00	7.03
trichloroethylene	ou	0.005	58.18	1,620.00	58.18
1.1.1-trichloroethane	ou	0.005	NA	24,300.00	1,000.00
1 1 2-trichloroethane	ou	0.005	11.23	1,080.00	11.23
tetrachloroethylene	ou	0.005	12.55	2,700.00	12.55
1 1 1 2-tetrachloroethane	ou	0.005	24.62	8,100.00	24.62
1.1.2.2-tetrachloroethane	ou	0.005	3.20	NA	3.20
chloroform	ou	0.005	104.92	2,700.00	104.92
acetone	ou	0.100	NA	27,000.00	1,000.00
4-methyl-2-pentanone	ou	0.050	AN	13,500.00	1,000.00
methyl ethyl ketone	ou	0.100	NA	13,500.00	1,000.00
Aldrin	yes	0.003	0.04	1.62	0.04
gamma-BHC (Lindane)	yes	0.006	0.49	16.20	0.49
chlordane	yes	0.009	0.49	3.24	0.49
DDD	yes	0.007	2.67	NA	2.67
DDE	yes	0.003	1.88	NA	1.88
DDT	yes	0.008	1.88	27.00	1.88
dieldrin	yes	0.001	0.04	2.70	0.04
endoentfan entfate	00	0.044	NA	13.50	13.50

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CRITERIA FOR SURFACE SOILS SUMMARY OF HEALTH-BASED TABLE 12

RESIDENTIAL LAND USE SCENARIO

•		Practical	Surfa	Surface Soils	
Chemical	Compound is	Quantitation	Carcinogenic	Noncarcinogenic	Surface Soil
Name	Bioaccumulatable *	Limit ⁹	Effects @10-6	Effects	Criteria
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mø/Kø)
endrin	yes	0.004	NA	16.20	16.20
heptachlor	yes	0.002	0.14	27.00	0.14
heptachlor epoxide	ou	0.056	0.07	3 51	700
PCBs *	yes	0.044	0.08	NA	0.0
ead	ou	0.500	NA	NA	NAN
cadmium	по	0.500	NA	135.00	135.00
Silver	ou	1.000	NA	1,350.00	1.350.00
mercury	yes	0.100	NA	16.20	16.20
chromium vi	no	1.000	NA	1.350.00	1 350 00
chromium iii	no	1.000	AN	270,000.00	10.000.00
barium	ou	20.000	NA	18,900.00	10,000 00
arsenic	по	1.000	NA	81.00	81.00
antimony	ou	000'9	NA	108.00	108.00
beryllium	ОП	0.500	0.15	1,350.00	0.50
cyanide	no	0.125	NA	5,400.00	1.000.00
nickei	no	4.000	NA	5,400.00	5.400.00
selenium	ou	0.500	NA	1,350.00	1,350.00
vanadıum	ou	5.000	NA	1.890.00	1 890 00
ZINC	ou	2.000	NA	81,000.00	10.000.00
LON	NOTES: a Commonne that are secumed to be bis	Cold of the beautiful			

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993. b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

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SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
RESIDENTIAL LAND USE SCENARIO

		Practical	Subsu	Subsurface Soils	Leaching to Groundwater	Groundwater	
Chemical	Compound is	Quantitation	Carcinogenic	Noncarcinogenic	Groundwater	Subsurface	Subsurface
Name N	Bioaccumulatable 1	Limit b	Effects @10-6	Effects	Criteria	Soil Criteria	Soil Criteria
	(ves/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(mg/Kg)	(mg/Kg)
nanhthalene	no	0990	NA	58,400.00	1.21600	1,761.785	1,761.785
acenanhthvlene	OU	0990	NA	NA	NA	NA	NA
acenanhthene	OU	0.660	NA	87,600.00	1.82400	10,906.498	10,000.000
fliorene	OU	0.660	NA	58,400.00	1.21600	8,838.641	8,838.641
nhenanthrene	OU	0990	NA	AN	NA	AN	NA
anthracene	OU	099.0	NA	438,000.00	9.12000	1,268,642.929	10,000.000
fluoranthene	ves	099.0	AN	11,680.00	0.24320	2,305.040	2,305.040
nucleur	ou	099.0	NA	43,800.00	0.91200	23,512.317	10,000.000
henzo(a)anthracene*	Ves	099.0	698.63	AN	0.01000	103.881	103.881
chrysene*	ves	0.660	69,863.01	AN	0.01164	379.273	379.273
henzo(h)fluoranthene*	ves	099.0	. 698.63	AN	0.01000	354.977	354.977
henzo(k)fluoranthene*	ves	099.0	6,986.30	NA	0.01000	501.638	501.638
henzo(a)nvrene	yes	099.0	69.85	NA	0.01000	212.868	69.846
indeno(1.2.3-cd)pyrene*	yes	0.660	698.63	NA	0.01000	629.166	991.629
dibenzo(a h)anthracene*	yes	099.0	98.69	NA	0.01000	649.661	69.863
henzo(ø h i)nervlene	yes	0.660	Ϋ́Z	NA	NA	NA	AN
3 3'-dichlorobenzidine	u	1.300	1,133.33	AN	0.02000	12.865	12.865
n-nitroso-di-n-propylamine	ou	099.0	72.86	NA	0.01000	0.063	099.0
his/2-chloroisonronyl)ether	ou	099.0	1,472.23	58,400.00	0.01000	0.166	:
4-chloroaniline	u	1.300	AN	5,840.00	0.12160	186.921	186.921
2-chloronaphthalene	ou	0.660	AN	116,800.00	2.43200	11,478.065	10,000.000
2 4-dinitrotoluene	Ou	0.660	AN	2,920.00	0.06080	6.535	6.535
nexachlorobutadiene	yes	0.660	31.18		0.01000	6.777	7777
hexachloroethane	Ves	0.660	29,818.48	292.00	0.01000	1.153	1.153
sonhorone	ou	0.660	536,842.11	292,000.00	0.08947	1.433	1.433
henzyl alcohol	ou	1.300	NA	438,000.00	9.12000	728.618	728.618
his(2-chloroethyl)ether	Ou	0.660	66.24	NA	0.01000	0.062	099.0
nitrohomaono	Cu	0.660	NA AN	730.00	0.01520	0.289	0990

SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
RESIDENTIAL LAND USE SCENARIO

Cnemical Name	of purcumous						
וימוווכ	Si Danoquio	Quantitation		Noncarcinogenic	Groundwater	roundwater Subsurface	Subsurface
	bioaccumulatable	Cimit	Effects @10-6	Effects	Criteria	Soil Criteria	Soil Criteria
1.2 45.41	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(mg/Kg)	(mg/Kg)
1,2-dicilioropenzene	Ou	099.0	NA	131,400.00	2.73600	2.524.230	2 524 230
1,3-dichlorobenzene	OU	099.0	AN	NA	NA	NA	AN
1,4-dichlorobenzene	Ou	099.0	21,250.00	16,873.31	0.01000	0.897	0 807
1,2,4-trichiorobenzene	ou	099.0	NA	14,600.00	0.30400	235.033	235 033
nexachiorobenzene	ou	099.0	101.56	1,168.00	0.01000	165 569	101 564
nexachlorocyclopentadiene	ou	099.0	Y.	2.89	0.21280	652 914	7 891
n-nitrosodiphenyiamine	ou	099.0	104,081.63	NA	0.01735	3.177	3 177
Denzoic acid	Ou	3.300	NA	5,840,000.00	121,60000	136 098 441	10 000 000
2-nitroaniline	ou	3.300	NA	45.47	0.05000	2.080	3 300
pnenol	yes	099.0	NA	175,200.00	3.64800	110.173	110 173
z-metnyiphenol	ou	0.660	. NA	73,000.00	1 52000	178 63	179 63
3-methylphenol	ou	099.0	AN	NA	NA	NA	NA
4-methylphenol	ou	099.0	AN	73.000 00	1 52000	C3V 1L	71 467
2-chlorophenol	ou	0.660	NA	7.300.00	0 15200	1 045	1 045
2,4-dichlorophenol	ou	099.0	NA	4.380.00	0.00120	2 678	0636
2,4,5-trichlorophenol	ou	0.660	AN	146,000.00	3.04000	021.050	020100
2,4,6-trichlorophenol	ou	0.660	24,779.61	NA	0.01000	1500	0660.126
pentachlorophenol	no	3.300	4,250.00	43,800.00	0.05000	24.947	24 947
2,4-dinitrophenol	ou	3.300	NA	2,920.00	0.06080	1.232	3 300
ois(z-emyinexyi)phthalate	yes	099.0	36,428.57	5,840.00	0.01000	16.427	16.427
di a hittilahtholoto	no	0.660	NA	292,000.00	00080.9	70,517.828	10,000,000
diethylabtholoto	yes	0.000	NA	29,200.00	0.60800	1,034.967	1,034.967
di mathal alal ala	no	099.0	NA	1,168,000.00	24.32000	23.252.800	10.000.000
di nemyi phinalate	no	099.0	NA	14,600,000.00	304.00000	405.965.586	10.000.000
ur-nr-octyt phthalate	no	099.0	AN	29,200.00	0.60800	2,318.850	2.318.850
foliuma	по	0.005	289.96	NA	0.00500	0.059	0.059
ethylhenzene	no	0.005	NA	3,631.30	1.00000	278.926	278.926
	no	0.005	NA	9,928.27	1.31459	834.372	834.372

SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
RESIDENTIAL LAND USE SCENARIO

		Practical	Subsurf	Subsurface Soils	Leaching to (Leaching to Groundwater	•
[00] moral [Compound is	Ougntitation	Carcinogenic	Noncarcinogenic	Groundwater	Subsurface	Subsurface
Name	Bioaccumulatable 1	Limit b		Effects	Criteria	Soil Criteria	Soil Criteria
	(ves/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(mg/Kg)	(mg/Kg)
vulenec	ou	0.005	NA	2,920,000.00	00008:09	206,114.090	1000.000
Aylenes	OL	0.010	0.30	Ϋ́N	0.01000	0.129	0.129
chloroethone	OL CL	0.010	AN	3,693.46	23.16075	7,788.243	1000.000
1 1 distinguishing	C C	0.005	2.59	13,140.00	0.00700	0.084	0.084
1,1-dichlorodulyiche	Ou Ou	0.005	AN	1,386.78	0.64000	40.074	40.074
1.1 -dichioroethylene (ric)	011	0.005	AN	14,600.00	0.30400	17.140	17.140
1,2-dichloroethane	OLL	0.005	91.96	438,000.00	0.00500	0.025	0.025
1,z-uiciliolocilianic	00	0.005	437.11	8,760.00	0.00500	0.076	0.076
1 1 1 trichlorosthane	ou	0.005	NA	5,600.68	1.28753	229.642	229.642
1,1,1-tichloroethane	00	0.005	391.20	5,840.00	0.00500	0.035	0.035
tetrachloroethylene	00	0.005	1,634.72	14,600.00	0.00500	0.227	0.227
1 1 1 2-tetrachloroethane	00	0.005	1,291.02	43,800.00	0.00500	9200	
1 1 2 2 tatrachloroethane	Ou	0.005	1,052.52	NA	0.00500	0.044	
1,1,2,2-tell aciliotociliano	00	0.005	92.76	14,600.00	0.10000	2.082	
VIIIOIOIOIIII	Ou	0.100	NA	146,000.00	3.04000	22.793	22.793
4-methyl-2-pentanone	00	0.050	NA	73,000.00		68.147	
mathyl othyl ketone	Ou	0.100	NA	9,032.18	0.91772	11.620	
Aldrin	ves	0.003	4.35	8.76	0.00004	0.007	
gamma_RHC (Lindane)	yes	900.0	392.31	87.60		0.010	
chlordane	Ves	0.00	368.21	17.52	0.00200	4.512	
חחח	yes	0.007	2,125.00	NA	0.00035	0.270	
AUG	Ves	0.003	1,500.00	AN	0.00025	0.450	0.450
TUC	ves	0.008	1,418.50	146.00	0.00025	0.794	
dialdrin	ves	0.001	31.88	14.60	0.00002	0.003	
andoculfon culfate	ou u	0.044	AN	73.00	0.00152	2.007	2.007
Chidosultan suntano	ves	0.004	AN	87.60	0.00200	1.939	1.939
hantachlor	ves	0.002	55.28	146.00	0.00040	0.221	0.221
hentachlor enoxide	ou	0.056	56.04	18.98	0.00083	0.450	0.450
Inchasting spoores							

CRITERIA FOR SUBSURFACE SOILS SUMMARY OF HEALTH-BASED TABLE 13

RESIDENTIAL LAND USE SCENARIO

		Practical	Subsu	Subsurface Soils	Leaching to	Leaching to Groundwater	
Chemical	Compound is	Quantitation	Carcino	Noncarcinogenic	Groundwater	Subenriace	- Subsurface
Лате	Bioaccumulatable 1	Limit ^p	Effects @10-6	Effects -	Criteria	Soil Criteria	Soil Critorie
DOD	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/L)	(ma/Ka)	(ma/l/a)
rcbs	yes	0.044	66.23	AN	0 00065	700 V	(Bulking)
lead	ou	0.500	AN	AN	COOCO.	077.4	4.220
cadmium	по	0.500	AN	00.007	WN.	NA	NA
silver	Ou	1 000	VIV	7 300 00	0.01520	NA	730.000
mercury	Vec	100	VI	00.005,	0.15200	NA	7,300.000
chromium vi	200	0.100	W.	09./8	0.00182	NA	87.600
chromium	OII	1.000	NA	7,300.00	0.15200	AZ	7 300 000
Locing III	ou u	1.000	NA	1,460,000.00	30.40000	AN	10,000,000
UALIUITI	no	20.000	AN	102 200 00	2 12800	VIII	10,000,000
arsenic	Ou	1 000	Y.V	00.007,201	2.12000	NA	10,000.000
antimony		000	W	438.00	0.01000	NA	438.000
hervilium	OII	0.000	NA	584.00	0.0090.0	AN	584.000
Cvanide	no	0.500	. 118.60	7,300.00	0.00500	NA NA	118 605
niokol	no	0.125	AN	29,200.00	0.60800	ΔN	10 000 000
IIICACI	no	4.000	AN.	29 200 00	0 60800	MIA	0000000
selenium	ou	0.500	AZ	7 300 00	0.00000	NA ::	10,000.000
vanadium	no	\$ 000	VN	00.000,00	0.13200	NA	7,300.000
zinc	CE	2000	V.	10,2220.00	0.21280	NA	10,000.000
Satur	NOTE: C. T.	7.000	AN	438,000.00	9.12000	AN	10.000.000
NOTES	. a - Compounds that are	accilment to be	oritoliuminosoit.	horse on annual 1.1			7

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993. b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

TABLE 14 SUMMARY OF TIER II CLEANUP GOALS FOR THE NONRESIDENTIAL SCENARIO

Chemical	Compound is	Surface	Subsurface	
Name	Bioaccumulatable	Soils	Soils	Groundwater
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/L)
naphthalene	ou	10,000.00	10,000.00	4.0880
acenaphthylene	ou	NA	NA	NA
acenaphthene	ou	10,000.00	10,000.00	6.1320
fluorene	ou	10,000.00	10,000.00	4.0880
phenanthrene	ou	NA	NA	NA
anthracene	ou	10,000.00	10,000.00	30.6600
fluoranthene	yes	10,000.00	10,000.00	0.8176
pyrene	ou	10,000.00	10,000.00	3.0660
benzo(a)anthracene*	yes	79.45	103.88	0.0100
chrysene*	yes	7,945.21	10,000.00	0.3918
benzo(b)fluoranthene*	yes	79.45	354.98	0.0100
benzo(k)fluoranthene*	yes	794.52	3,759.12	0.0392
benzo(a)pyrene	yes	7.94	69.85	0.0100
indeno(1,2,3-cd)pyrene*	yes	79.45	629.17	0.0100
dibenzo(a,h)anthracene*	yes	7.95	98.69	0.0100
benzo(g,h,i)perylene	yes	NA	NA	NA
3,3'-dichlorobenzidine	ou	128.89	12.86	0.0200
n-nitroso-di-n-propylamine	0u	8.29	99.0	0.0100
bis(2-chloroisopropyl)ether	no	93.12	1.32	0.0409
4-chloroaniline	ou	8,160.00	1,117.69	0.4088
2-chloronaphthalene	ou	10,000.00	10,000.00	8.1760
2,4-dinitrotoluene	ou	4,080.00	39.07	0.2044
hexachlorobutadiene	yes	1.78	31.18	0.0367
hexachloroethane	yes	408.00	3.31	0.0204
isophorone	ou	10,000.00	256.03	3.0105
benzyl alcohol	no	10,000.00	4,356.75	30.6600
bis(2-chloroethyl)ether	ou	4.06	99.0	0.0100

SUMMARY OF TIER II CLEANUP GOALS FOR THE NONRESIDENTIAL SCENARIO

Chemical	Compound is	Surface	Subsurface	
Name	Bioaccumulatable 1	Soils	Soils	Groundwater
	(yes/no)	(mg/Kg)	(mg/Kg)	(Wam)
nitrobenzene	00	1.020.00	1 73	(1112/11)
1,2-dichlorobenzene	ou	10.000.00	10 000 00	0.0311
1,3-dichlorobenzene	ou	AN	NA NA	7.190U
1,4-dichlorobenzene	ou	2.416.67	L9 PE	01100
1,2,4-trichlorobenzene	ou	10,000.00	1 405 37	1 0000
hexachlorobenzene	OU	6.87	101.56	0.0100
nexachlorocyclopentadiene	Ou	2.02	2.89	0.2150
n-nitrosogiphenylamine	ou	10,000.00	567.80	0.5837
2 mitrografia	no	10,000.00	10,000.00	408.8000
z-introdinine	no	. 42.90	3.30	0.0500
2 mothylphonol	yes	10,000.00	658.78	12.2640
2 methylphenol	no	10,000.00	375.93	5.1100
A mothylphenol	no	NA	NA	NA
7 oblogophenel	no	10,000.00	427.24	5.1100
2 4-dichlorophenol	0U	10,000.00	11.63	0.5110
2.4 Strickloneshonel	по	6,120.00	15.12	0.3066
2.4.3-uichlorophenol	no	10,000.00	5,507.44	. 10.2200
pentachlorophenol	no	1,922.89	30.65	0.2600
2 4-dinitronhand	по	483.33	24.95	0.0500
his(2-ethylhexyl)nhthalata	no	4,080.00	7.37	0.2044
hutvihenzylnhthalate	yes	4,142.86	1,406.25	0.2043
di-n-hutvinhthalata	no	10,000.00	10,000.00	20.4400
diethylphthalate	yes	10,000.00	6,188.56	2.0440
di methyl ahtholote	no	10,000.00	10,000.00	81.7600
di-n-octyl phthologo	no	10,000.00	10,000.00	1.022.0000
henzene	no	10,000.00	10,000.00	2.0440
	no	16.63	4.77	0.0986

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TABLE 14 SUMMARY OF TIER II CLEANUP GOALS FOR THE NONRESIDENTIAL SCENARIO

toluene		Coile	Coile	
luene	(yes/no)	(mg/Kg)	Solis (mg/Kg)	Groundwater (mg/L)
The state of the s	ou	1,000.00	1,000.00	20.4400
ethylbenzene	ou	1,000.00	1,000.00	10.2200
xylenes	no	1,000.00	1,000.00	204.4000
vinyl chloride	ОП	0.02	0.13	0.0100
chloroethane	ou	1,000.00	1,000.00	NA
,1-dichloroethylene	ou	0.15	0.08	0.0070
1-dichloroethane	ОП	973.47	1,000.00	10.2200
,2-dichloroethylene (cis)	ОП	1,000.00	102.49	1.0220
,2-dichloroethane	ou	5.27	0.37	0.0314
trichloroethylene	ОП	24.97	25.73	0.2600
, l, l-trichloroethane	ou	1,000.00	1,000.00	9.1980
1,2-trichloroethane	no	22.74	1.05	0.0502
tetrachloroethylene	ou	101.23	8.01	0.0561
, 1, 1, 2-tetrachloroethane	ou	75.91	7.24	0.1100
1,2,2-tetrachloroethane	ou	75.41	0.21	0.0143
chloroform	ou	5.28	20.33	0.4689
acetone	ou	1,000.00	136.29	10.2200
4-methyl-2-pentanone	ou	1,000.00	407.48	5.1100
methyl ethyl ketone	ou	1,000.00	146.24	5.1100
Aldrin	yes	0.27	90.0	0.0002
gamma-BHC (Lindane)	yes	44.62	0.34	0.0022
chlordane	yes	24.48	4.51	0.0020
DDD	yes	241.67	48.34	0.0119
DDE	yes	170.59	80.49	0.0084
	yes	153.01	141.83	0.0084
dieldrin	yes	3.63	90.0	0.0002
endosultan sultate	ou	102.00	12.00	0.0051

SUMMARY OF TIER II CLEANUP GOALS FOR THE NONRESIDENTIAL SCENARIO TABLE 14

Name Bioaccumulatable (yes/no) Soils (mg/Kg) rin yes 4.16 achlor epoxide no 4.16 as biological achievation and control of a chievation and chieva	Chemical	Compound is	Surface	Subsurface	
rin (yes/no) (mg/Kg) (mg/Kg) (mg/Kg) (mg/Lg) (Name	Bioaccumulatable 1	Soils	Soils	Groundwater
trin yes 122.40 LESTALO (LIBERAL) CHIRCLE		(yes/no)	(mg/Kg)	(mg/Kg)	(ma/l)
or ves 4.16 0.44 or epoxide no 6.37 0.45 no ves 7.53 4.23 no 1,020.00 730.00 no 1,020.00 7,300.00 no 10,000.00 7,300.00 niii no 10,000.00 10,000.00 niii no 10,000.00 10,000.00 no 11,000.00 11,000.00 11,000.00 no 10,000.00 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00	endrin	Ves	. _		
tacklor epoxide no 6.37 0.44 3s yes 7.53 4.23 nium no NA NA r no 1,020.00 730.00 cury yes 12.40 87.60 mium vi no 10,000.00 10,000.00 mi no 10,000.00 10,000.00 nic no 612.00 438.00 nic no 13.49 118.60 ide no 10,000.00 10,000.00 cl no 10,000.00 7,300.00 cl no 10,000.00 10,000.00 dium no 10,000.00 10,000.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00	heptachlor	Ves	01.221 A 16	10.12	0.0061
10	heptachlor epoxide	04	01.4	0.44	0.0006
December Pass Pas	PCRe	O	6.37	0.45	0.0008
nium NA NA rium no 1,020.00 730.00 ear no 1,020.00 7,300.00 rium no 10,000.00 7,300.00 10,000.00 mic no 10,000.00 10,000.00 10,000.00 nic no 612.00 438.00 884.00 ilium no 13.49 118.60 118.60 el no 10,000.00 10,000.00 10,000.00 inium no 10,000.00 10,000.00 10,000.00 inium no 10,000.00 10,000.00 10,000.00 inium no 10,000.00 10,000.00 10,000.00	Los	yes	7.53	4.23	0.0007
1,020.00 730.00 730.00 730.00 730.00 730.00 7300.00 730.00 730.00 730.00 730.00 730.00 730.00 7300.00 730.00	rodm in	no	NA	NA	NA
sir no 19,000.00 7,300.00 cury yes 122.40 87.60 mium iii no 10,000.00 7,300.00 um no 10,000.00 10,000.00 nic no 612.00 438.00 no 612.00 816.00 584.00 Illum no 13.49 118.60 el no 1,000.00 10,000.00 el no 10,000.00 7,300.00 vium no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 dium no 10,000.00 10,000.00	Cadmium	ou	1,020.00	730.00	0.0511
cury yes 122.40 \$7.60 mium vi no 10,000.00 7,300.00 um no 10,000.00 10,000.00 nic no 612.00 438.00 nony 816.00 584.00 Illium no 13.49 118.60 el no 10,000.00 10,000.00 el no 10,000.00 10,000.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00	SIIVer	ou	10,000.00	7.300.00	0 5110
minum vi minum iii no 10,000.00 7,300.00 10 um no 10,000.00 10,000.00 10,000.00 nic no 612.00 438.00 nony 816.00 584.00 Illium no 13.49 118.60 el no 10,000.00 10,000.00 el no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00	mercury	yes	122.40	87.60	0.000
mitim no 10,000.00 10,000.00 10,000.00 um no 10,000.00 10,000.00 10,000.00 nic no 612.00 438.00 Hitim no 13.49 118.60 el no 10,000.00 10,000.00 el no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00	chromium vi	ou	10.000.00	7 300 00	0.0001
um no 10,000.00 10,000.00 10,000.00 nic no 612.00 438.00 438.00 Ilium no 816.00 584.00 584.00 ilde no 13.49 118.60 10,000.00 el no 10,000.00 10,000.00 10,000.00 dium no 10,000.00 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00	chromium iii	ou	10,000,00	00.000,	01100
nic no 19,000,00 nony 612,00 438,00 illium no 816,00 584.00 iide no 13.49 118.60 el no 10,000.00 10,000.00 dium no 10,000.00 10,000.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00	barium	OU	10,000,00	10,000.00	102.2000
mony no 816.00 438.00 ilium no 13.49 118.60 iide no 1,000.00 10,000.00 el no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00	arsenic	Ou	72,000.00	10,000.00	7.1540
Ilium	antimony	C F	012.00	438.00	0.0500
iide no 1,000.00 10,000.00 el no 10,000.00 10,000.00 nium no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00	beryllium		816.00	584.00	0.0600
el no 10,000.00 10,000.00 nium no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00	cvanide	OII G	13.49	118.60	0.0050
iium no 10,000.00 10,000.00 iium no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00	nickel	Oll	1,000.00	10,000.00	2.0440
no 10,000.00 7,300.00 dium no 10,000.00 10,000.00 no 10,000.00 10,000.00 10,000.00	o lanima	no	10,000.00	10,000.00	2.0440
10,000.00 10,000.00 10,000.00 10,000.00 10,000.00	Scientifili	no	10,000.00	7,300.00	0.5110
00.000.00 on 10.000.00	valiadium	ou	10,000.00	10.000.00	0.7154
	The second secon	ou	10,000.00	10.000.00	30,6600

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993. b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

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TABLE 15 SUMMARY OF TIER II CLEANUP GOALS FOR THE RESIDENTIAL SCENARIO

Chemical	Compound is	Surface	Subsurface	
Name	Bioaccumulatable "	Soils	Soils	Groundwater
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/L)
nanhthalene	no	10,000.00	1,761.785	1.21600
acenanhthylene	no	NA	NA	NA
acenanhthene	no	10,000.00	10,000.000	1.82400
fluorene	no	10,000.00	8,838.641	1.21600
nhenanthrene	ou	NA	NA	NA
anthracene	no	10,000.00	10,000.000	9.12000
fluoranthene	yes	2,160.00	2,305.040	0.24320
nvrene	no	8,100.00	10,000.000	0.91200
henzo(a)anthracene*	yes	0.88	103.881	0.00010
chrysne*	yes	79.78	379.273	0.00020
henzo(h)fluoranthene*	yes	0.88	354.977	0.00020
henzo(k)fluoranthene*	yes	8.77	501.638	0.00020
henzo(a)pyrene	yes	99.0	69.846	0.00020
indeno(1.2.3-cd)pyrene*	yes	0.88	991.169	0.00040
dibenzo(a,h)anthracene*	yes	99.0	69.863	0.00030
benzo(g.h.i)pervlene	yes	NA	NA	NA
3.3'-dichlorobenzidine	ou	1.42	12.865	0.02000
n-nitroso-di-n-propylamine	ou	99.0	099.0	0.01000
bis(2-chloroisopropyl)ether	ou	9.14	099.0	0.01000
4-chloroaniline	ou	1,080.00	186.921	0.12160
2-chloronaphthalene	ou	10,000.00	10,000.000	2.43200
2.4-dinitrotoluene	ou	540.00	6.535	0.06080
hexachlorobutadiene	yes	8.21	6.777	0.01000
hexachloroethane	yes	45.07	1.153	0.01000
isophorone	ou	673.68	1.433	0.08947
benzyl alcohol	ou	10,000.00	728.618	9.12000
bis(2-chloroethyl)ether	Ou	99'0	099.0	0.01000

SUMMARY OF TIER II CLEANUP GOALS FOR THE RESIDENTIAL SCENARIO

eue eue	Chemical	Compound is	Surface	Subsurface	
Color Colo		Bioaccumulatable (voc/no)	Soils	Soils	Groundwater
re no 135.00 0.660 re no 10,000.00 2,524,230 re no NA NA rete no 2,700.00 2,524,333 rete no 2,700.00 235.033 rete no 1,800.00 2,350.00 10,564 mine no 1,800.00 10,500.00 12,544 mine no 10,000.00 10,000.00 12,331 12,331 res no 10,000.00 10,000.00 110,173 23,300 12,452 12,452 12,452 12,452 12,452 12,452 12,452 12,452 12,452 12,452 12,442 12,442 12,444 12,440 12,440 <th>nitrobenzene</th> <th>Calling</th> <th></th> <th>(mg/Kg)</th> <th>(mg/L)</th>	nitrobenzene	Calling		(mg/Kg)	(mg/L)
Color Colo	1.2-dichlorohenzene	OII	135.00	099:0	0.01520
NA NA NA NA NA NA NA NA	1.3-dichlorohenzene	по	10,000.00	2,524.230	0.60000
Column	1 4-dichlorohenzene	no	NA	NA	0.60000
Total column	1 2 4-trichlorohanzana	no	26.67	0.897	0.07500
mine no 1,890.00 101.564 mine no 1,890.00 2.891 mine no 10,000.00 2.891 no 16,000.00 10,000.000 10,000.000 yes 10,000.00 62.871 no 10,000.00 62.871 no 10,000.00 77.452 ol no 810.00 2.528 ol no 810.00 2.528 ol no 810.00 2.528 ol no 810.00 921.059 stalate yes 45.71 16.427 0 e no 540.00 10,000.00 24.947 0 e no 10,000.00 10,000.00 24.947 0 e no 10,000.00 10,000.00 24.947 0 e no 10,000.00 10,000.00 10,000.00 24.947 0 e no 10,000.00 10,000.00 10,	hexachlorohenzene	no	2,700.00	235.033	0.07000
1,890,00 1,890,00 2,891 3,177	hexachlorocyclonentadiene	no	99'0	101.564	0.00100
130.61 3.177 1.00 1.000.00 1.000.000 1.000	n-nitrosodiphenylamine	0U	1,890.00	2.891	0.05000
10,000,000 10,000,000 12 12 13 13 10 13 10 13 13 10 13 10 13 13	benzoic acid	011	130.61	3.177	0.01735
16.20 3.300 3.300 1.000.00 1.00.173 1.000.00 1.000.173 1.0000.00 1.00.173 1.0000.00 1.0000.0	2-nitroaniline	no	10,000.00	10,000.000	121.60000
yes 10,000,00 110,173 no 10,000,00 62,871 no NA NA no 10,000,00 62,871 no 1,350,00 71,452 no 810,00 2,528 ol no 25,28 no 58,18 0,660 no 58,18 0,660 e no 540,00 yes 45,71 16,427 no 10,000,00 1,034,967 no 10,000,00 1,034,967 no 5,400,00 10,000,000 no 2,318,850 0,059	phenol	no	16.20	3.300	0.05000
no 10,000.00 62.871 no NA NA no 10,000.00 71.452 no 1,350.00 1.945 ol no 810.00 2.528 ol no 58.18 0.660 on 5.33 24.947 e no 45.71 16.427 e no 10,000.00 1,034.967 0 no 10,000.00 1,034.967 0 no 5,400.00 1,034.967 0 no 5,400.00 1,0300.000 3.30 no 5,400.00 1,0300.000 22.318.850 no 22.07 0.059 0	2-methylphenol	yes	10,000.00	110.173	3.64800
no no 10,000.00 71,452 1 ol no 1,350.00 1,945 0 ol no 810.00 2.528 0 ol no 58.18 0.660 0 no 540.00 3.300 0 e no 10,000.00 10,000.00 0 yes 5,400.00 1,034.967 0 po no 10,000.00 10,000.000 24 no 5,400.00 10,000.000 24 no 5,400.00 2,318.850 0 no 22.07 0.059 0	3-methylphenol	NO NO	10,000.00	62.871	1.52000
no 10,000.00 71.452 no 1,350.00 1.945 ol no 2.528 ol no 58.18 0.660 thalate yes 45.71 16.427 e no 10,000.00 1,034.967 no 10,000.00 10,000.000 2,318.850 no 5,400.00 10,000.000 30.59	4-methylnhenol	no	NA	NA	NA
ol no 1,350.00 1 945 ol no 810.00 2.528 ol no 58.18 0.660 c no 5.33 24.947 e no 540.00 3.300 e no 10,000.00 1,034.967 e no 10,000.00 1,034.967 no 10,000.00 10,000.000 2,400.00 no 10,000.00 10,000.000 2,318.850 no 22.07 0.059	2-chlorophenol	no	10,000.00	71.452	1.52000
ol 810.00 2.528 ol no 10,000.00 921.059 chalate yes 45.71 16.427 chalate yes 5,400.00 1,034.967 no 10,000.00 1,034.967 no 10,000.00 10,000.000 no 5,400.00 10,000.000 no 5,400.00 2,318.850 no 5,400.00 2,318.850	2.4-dichlorophenol	Ou	1,350.00	1.945	0.15200
ol no 10,000.00 921.059 no 58.18 0.660 thalate yes 45.71 16.427 e no 10,000.00 1,034.967 no 10,000.00 1,034.967 no 10,000.00 10,000.000 no 5,400.00 10,000.000 no 5,400.00 2,318.850 no 22.07 0.059	2.4.5-trichloronhenol	no no	810.00	2.528	0.09120
thalate begin mo	2,4,6-trichlorophenol	no no	10,000.00	921.059	3.04000
thalate yes 5.33 24.947 e no 540.00 3.300 yes 10,000.00 10,000.00 yes 5,400.00 1,034.967 no 10,000.00 1,034.967 no 10,000.00 10,000.000 no 5,400.00 2,318.850 no 22.07 0.059	pentachlorophenol	ПО	58.18	099.0	0.01000
thalate yes 340.00 3.300 e no 10,000.00 10,000.00 yes 5,400.00 1,034.967 no 10,000.00 10,000.000 no 5,400.00 10,000.000 no 5,400.00 2,318.850 no 5,400.00 2,318.850 no 22.07 0.059	2,4-dinitrophenol	OII	5.33	24.947	0.00100
e f.25 45.71 16.427 no 10,000.00 10,000.000 yes 5,400.00 1,034.967 no 10,000.00 10,000.000 no 5,400.00 10,000.000 no 5,400.00 2,318.850 no 22.07 0.059	bis(2-ethylhexyl)phthalate	Oil	540.00	3.300	0.06080
yes 10,000.00 10,000.000 no 10,000.00 1,034.967 no 10,000.00 10,000.000 2 no 5,400.00 2,318.850 30 no 22.07 0.059	butylbenzylphthalate	200	45.71	16.427	0.00600
yes 5,400.00 1,034.967 no 10,000.00 10,000.000 2 no 5,400.00 2,318.850 30 no 22.07 0.059	di-n-butylphthalate		10,000.00	10,000.000	0.10000
no 10,000.00 10,000.000 2 no 10,000.00 10,000.000 30 no 5,400.00 2,318.850 30 no 22.07 0.059	diethylphthalate	Nas.	5,400.00	1,034.967	0.60800
no 10,000.00 10,000.000 3 no 5,400.00 2,318.850 no 22.07 0.059	di methyl phthalate	no	10,000.00	10,000.000	24 32000
n0 5,400.00 2,318.850 n0 22.07 0.059	di-n-octvl phthalate	no	10,000.00	10,000.000	304.0000
110 222.07 0.059	benzene	Ou	5,400.00	2,318.850	0.60800
		ПО	22.07	0.059	0.00500

TABLE 15 SUMMARY OF TIER II CLEANUP GOALS FOR THE RESIDENTIAL SCENARIO

Bioaccumulatable (yes/no) (yes/no) no no no no no no no no no	Chemical	Compound is	Surface	Subsurface	
(yes/no) no no no no no no no	Name	ioac	Soils	Soils	Groundwater
oride hane lorocthylene lorocthane lorocthane ethylene chlorocthane chlorocthane chlorocthane chlorocthane tetrachlorocthane tetrachlorocthane tetrachlorocthane tetrachlorocthane tetrachlorocthane bethylene chlorocthane tetrachlorocthane tetrachlorocthane bethylene retrachlorocthane tetrachlorocthane bethylene tetrachlorocthane tetrachlorocthane bethylene tetrachlorocthane bethylene tetrachlorocthane bethylene tetrachlorocthane bethylene tetrachlorocthane bethylene		(yes/no)	(mg/Kg)	(mg/Kg)	(mg/L)
loride hane loroethylene loroethane loroethane elhoroethane chloroethane chloroethane etrachloroethane tetrachloroethane tetrachloroethane etrachloroethane etrachloroethane tetrachloroethane betrachloroethane etrachloroethane brown l-2-pentanone ethyl ketone brown l-3-pentanone ethyl ketone ethyl ketone brown l-3-pentanone ethyl ketone ethyl ketone ethyl ketone		no	1,000.00	278.926	1.00000
loride hane loroethylene loroethane loroethane ethylene chloroethane chloroethane etrachloroethane etrachloroethane etrachloroethane etrachloroethane etrachloroethane etrachloroethane etrachloroethane brum l-2-pentanone ethyl ketone ethyl ketone bruck loroethane brum letrachloroethane ethyl ketone ethyl ketone ethyl ketone ethyl ketone me	70000	0U	1,000.00	834.372	0.70000
loride hane loroethylene loroethane loroethane orthylene chloroethane chloroethane crischloroethane tetrachloroethane orm l-2-pentanone ethyl ketone ethyl ketone beloride belore chloroethane chloroethane orm l-2-pentanone ethyl ketone ethyl ketone beloride belore chloroethane orm letrachloroethane orm letra		UU	1,000.00	1,000.000	10.0000
loroethylene loroethylene loroethane loroethane sethylene chloroethane chloroethane chloroethane setrachloroethane letrachloroethane syrm l-2-pentanone ethyl ketone BHC (Lindane) ne	Orida	0U	0.34	0.129	0.00200
loroethylene loroethane loroethane loroethane chloroethane chloroethane chloroethane tetrachloroethane tetrachloroethane syrm l-2-pentanone ethyl ketone ethyl ketone bHC (Lindane) ne	hane	00	AN	1,000.000	23.16075
loroethane loroethane loroethane chloroethane chloroethane chloroethane tetrachloroethane tetrachloroethane tetrachloroethane letrachloroethane stry letrachloroethane	loroethylene	ou	1.07	0.084	0.00700
loroethylene (cis) loroethylene sethylene chloroethane chloroethane tetrachloroethane tetrachloroethane tetrachloroethane tetrachloroethane sethyl ketone ethyl ketone bHC (Lindane) ne	loroethane	ou	1,000.00	40.074	0.64000
loroethane eethylene chloroethane chloroethane eetrachloroethane eetrachloroethane orm /l-2-pentanone ethyl ketone ethyl ketone ne	doroethylene (cis)	ou	1,000.00	17.140	0.07000
chloroethane chloroethane oroethylene tetrachloroethane orm l-2-pentanone ethyl ketone ethyl ketone bHC (Lindane) ne	loroethane	no	7.03	0.025	0.00500
chloroethane chloroethane oroethylene tetrachloroethane tetrachloroethane orm l-2-pentanone ethyl ketone bHC (Lindane) ne	nethylene	ou	58.18	9/0.0	0.00500
chloroethane betrachloroethane tetrachloroethane retrachloroethane retrachloroethane retrachloroethane srm d-2-pentanone ethyl ketone BHC (Lindane) ne	ichloroethane	ou	1,000.00	229.642	0.20000
roethylene letrachloroethane letrachloroethane orm /l-2-pentanone ethyl ketone BHC (Lindane) ne	chloroethane	u	11.23	0.035	0.00500
tetrachloroethane tetrachloroethane strm /l-2-pentanone ethyl ketone BHC (Lindane) ne	ornethvlene	ou	12.55	0.227	0.00500
retrachloroethane orm /l-2-pentanone ethyl ketone BHC (Lindane) ne	tetrachloroethane	Ou	24.62	9200	0.00500
orm 1-2-pentanone ethyl ketone BHC (Lindane) ne	tetrachloroethane	u	3.20	0.044	0.00500
1-2-pentanone ethyl ketone BHC (Lindane) ne		ou	104.92	2.082	0.10000
rl-2-pentanone ethyl ketone BHC (Lindane) ne		no	1,000.00	22.793	3.04000
	vI-2-nentanone	no	1,000.00	68.147	1.52000
HC (Lindane)	ethyl ketone	n	1,000.00	11.620	0.91772
HC (Lindane)		yes	0.04	0.007	0.00004
	-BHC (Lindane)	yes	0.49	0.010	0.00020
	ne	yes	0.49	4.512	0.00200
		ves	2.67	0.270	0.00035
		yes	1.88	0.450	0.00025
		yes	1.88	0.794	0.00025
		yes	0.04	0.003	0.00002
fan sulfate	lfan sulfate	ou	13.50	2.007	0.00152

SUMMARY OF TIER II CLEANUP GOALS FOR THE RESIDENTIAL SCENARIO TABLE 15

Chemical Name	Compound is Bioaccumulatable	Surface Soils	Subsurface Soils	Groundwater
	(yes/no)	(mg/Kg)	(mg/Kg)	(mg/L)
endrin	yes	16.20	1 939	00000
heptachlor	yes	0.14	0.221	0.0000
heptachlor epoxide	OU	0 0 0	0.450	0.00040
PCBs	Ves	000	0CF.0	0700070
lead	Ou	NIA NIA	077.4	0.0000
e adminim		YN .	NA.	AN
Caulifulli	по	135.00	730.000	0.00500
SIIVer	00	1,350.00	7,300.000	0.15200
mercury	yes	16.20	87.600	0.00200
chromium vi	Ou	1,350.00	7.300.000	0 10000
chromium iii	ou	10.000.00	10 000 000	0.0001.0
barium	ou	10,000,00	10 000 000	2,0000
arsenic	ou	81 00	438 000	0.05000
antimony	ou	00801	584 000	0.0000
beryllium	ou	0.50	118 605	0.00000
cyanide	ou	1,000,00	10 000 000	0.00400
nickel	ou	5,400.00	10,000,000	0.20000
selenium	ou	1,350.00	7.300.000	0.05000
vanadium	00	1.890.00	10,000,000	0.00000
zinc	Ou	10,000.00	10.000.000	9 12000
VELLON	NOTES: a - Compounds that are assumed to be bigger	1		

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

APPENDIX G: INDIANA CODE CHAPTER 13 - ARTICLE 11. CHAPTER 2 - DEFINITIONS

Section.

- 13-11-2-67...."Enforcement Action" defined.
- 13-11-2-98...."Hazardous substance" defined.
- 13-11-2-160...."Petroleum" defined.
- 13-11-2-184(e)...."Release" defined.
- 13-11-2-186...."Remediation" defined.
- 13-11-2-203(a)...."Site" defined.

13-11-2-67. Enforcement action. - "Enforcement action", for purposes of IC 13-25-5, means:

- (1) a written notice of violation issued under
- IC 13-30-3-3, IC 13-30-3-4, or IC 13-7-11-2 (before its repeal) that requires or involves the removal or remediation of petroleum or a hazardous substance;
 - (2) another written notice that requires the removal or remediation of petroleum or a hazardous substance and that is:
 - (A) issued under:
 - (i) IC 4-21.5-3-6;
 - (ii) IC 4-21.5-3-8; or
 - (iii) IC 4-21.5-4; or
 - (B) substantially equivalent to a special notice letter issued under 42 U.S.C. 9622(e); or
 - (3) a similar notice issued by the federal government.
- **13-11-2-98. Hazardous substance.** "Hazardous substance", for purposes of IC 13-25-4 and IC 13-25-5, has the meaning set forth in Section 101 of CERCLA (42 U.S.C. 9601). The term includes any substance that the solid waste management board determines to be hazardous under environmental management laws.
- 13-11-2-160. Petroleum. "Petroleum", for purposes of:
 - (1) IC 13-23;
 - (2) IC 13-24-1; and
 - (3) IC 13-25-5;

includes petroleum and crude oil or any part of petroleum or crude oil that is liquid at standard conditions of temperature and pressure (sixty (60) degrees Fahrenheit) and fourteen and seven-tenths (14.7) pounds per square inch absolute.

- **13-11-2-184. Release.** (e) "Release", for purposes of IC 13-25-5, means any:
 - (1) spilling;
 - (2) leaking;
 - (3) pumping;
 - (4) pouring;
 - (5) emitting;
 - (6) emptying;
 - (7) discharging;

- (8) injecting;
- (9) escaping;
- (10) leaching;
- (11) dumping; or
- (12) disposing;

into the environment. The term includes the abandonment or discarding of barrels, containers, or other closed receptacles containing any hazardous substance or petroleum.

13-11-2-186. Remediation. - "Remediation", for purposes of IC 13-25-5, means any of the following:

- (1) Actions necessary to:
 - (A) prevent;
 - (B) minimize; or
 - (C) mitigate;

damages to the public health or welfare or to the environment that may otherwise result from a release or threat of a release.

- (2) Actions consistent with a permanent remedy taken instead of or in addition to removal actions if a release or threatened release of a hazardous substance or petroleum into the environment occurs to eliminate the release of hazardous substances or petroleum so that the hazardous substances or petroleum do not migrate to cause substantial danger to present or future public health or welfare or the environment.
- (3) The cleanup or removal of released hazardous substances or petroleum from the environment.

13-11-2-203. Site. - (a) "Site", for purposes of IC 13-25-5, means a parcel of real property for which an application has been submitted under IC 13-25-5-2.

INDIANA CODE CHAPTER 13 - ARTICLE 25. CHAPTER 5 - VOLUNTARY REMEDIATION OF HAZARDOUS SUBSTANCES AND PETROLEUM

Section.

- 13-25-5-1....Purpose Liability of participant.
- 13-25-5-2....Application and fee Confidentiality.
- 13-25-5-3....Environmental assessment.
- 13-25-5-4....Eligibility determination.
- 13-25-5-5....Rejection of application Reasons Incomplete application Notice to applicant.
- 13-25-5-6....Rejection of application Appeal Completion of application Refund.
- 13-25-5-7....Proposed voluntary remediation work plan Requirements.
- 13-25-5-8....Voluntary remediation agreement Failure to reach agreement.
- 13-25-5-9....Review and evaluation by department Recommendation Request for information.
- 13-25-5-10....Approval, modification, or rejection of work plan.
- 13-25-5-11....Notification of local government units and public Comment period Public hearing.
- 13-25-5-12....Rejection of work plan Notice to applicant Appeal.
- 13-25-5-13....Notice of approval, or modification and approval of work plan.
- 13-25-5-14....Notice of intent to implement work plan.
- 13-25-5-15....Oversight and review of implementation by department Reports to commissioner.
- 13-25-5-16....Certificate of completion.
- 13-25-5-17....Notice applicant has not successfully completed work plan.
- 13-25-5-18....Covenant not to sue Actions prohibited during implementation.
- 13-25-5-19....Withdrawal of approval of work plan.
- 13-25-5-20....Claims against third parties Liability for matters addressed in work plan or certificate of completion.
- 13-25-5-21....Voluntary remediation fund.
- 13-25-5-22....Transfer from environmental management special fund Reimbursement {expires August 1, 1998}.
- 13-25-5-23....Adoption of rules.

13-25-5-1. Voluntary Remediation: Purpose - Liability of participant. -

(a) This chapter is intended to provide an alternative procedure to assure compliance with the law. A person who performs an action under an approved remediation work plan is performing the action to comply with existing legal obligations to protect human health and the environment.

(b) This section does not affect a person's legal obligations set forth in 42 U.S.C. 6901 et seq. regardless of a person's participation in this chapter.

13-25-5-2. Voluntary Remediation: Application and fee - Confidentiality. -

- (a) A person who desires to participate in the voluntary remediation program under this chapter must submit an application and a fee to the department as described under subsection (c).
- (b) Except as provided under section 5 of this chapter, any information submitted to the division of the department responsible for reviewing and making determinations on applications under this chapter is confidential between the applicant and the department.
- (c) An application submitted under this section must meet the following conditions:
 - (1) Be on a form provided by the department.

- (2) Contain the following:
 - (A) General information concerning:
 - (i) the person;
 - (ii) the site; and
 - (iii) other background information;

as requested by the department.

- (B) An environmental assessment of the actual or threatened release of the hazardous substance or petroleum at the site.
- (3) Be accompanied by an application fee of one thousand dollars (\$1,000).
- (d) A fee collected under this section shall be deposited in the voluntary remediation fund established by section 21 of this chapter.

13-25-5-3. Voluntary Remediation: Environmental assessment. -

An environmental assessment described under section 2(c)(2)(B) of this chapter must include the following:

- (1) A legal description of the site.
- (2) The physical characteristics of the site.
- (3) The operational history of the site to the extent the

history is known by the applicant.

- (4) Information that the applicant is aware of concerning:
 - (A) the nature and extent of any relevant

contamination; and

(B) relevant releases;

at the site and immediately contiguous to the site.

(5) Relevant information the applicant is aware of concerning the potential for human exposure to contamination at the site.

13-25-5-4. Voluntary Remediation: Eligibility determination. -

Not more than thirty (30) days after receiving:

- (1) an application; and
- (2) an application fee;

under section 2 of this chapter, the department shall determine if the applicant is eligible to participate in the voluntary remediation program under this chapter.

13-25-5-5. Voluntary Remediation: Rejection of application - Reasons - Incomplete application - Notice to applicant. -

- (a) The department may reject an application submitted under section 2 of this chapter only for one (1) or more of the following reasons:
 - (1) A state or federal enforcement action that concerns the remediation of the hazardous substance or petroleum described in the application is pending.
 - (2) A federal grant requires an enforcement action at the site.
 - (3) The condition of the hazardous substance or petroleum described in the application constitutes an imminent and substantial threat to human health or the environment.
 - (4) The application is not complete.
- (b) If the application is rejected under subsection (a)(4), the department, not more than forty-five (45)

days after the department received the application, shall provide the applicant with a list of all information needed to make the application complete. If the department fails to comply with this subsection, the application shall be considered completed for the purposes of this chapter.

- (c) If the department rejects an application, the department shall do the following:
 - (1) As described under IC 4-21.5-3-4(b) and IC 4-21.5-3-4(c), notify the applicant that the department rejected the application.
 - (2) Explain the reason the department rejected the application.

13-25-5-6. Voluntary Remediation: Rejection of application - Appeal - Completion of application - Refund. -

- (a) If an applicant's application is rejected under section 5 of this chapter, the applicant may do the following:
 - (1) Appeal the department's decision under IC 4-21.5.
 - (2) If the application is rejected because the application is not complete, submit a completed application without submitting an additional application fee.
- (b) If an applicant's application is rejected and the applicant:
 - (1) does not appeal the rejection; or
 - (2) loses an appeal concerning the rejection;

the department shall refund any unexpended portion or the applicant's application fee.

13-25-5-7. Voluntary Remediation: Proposed voluntary remediation work plan - Requirements. -

- (a) If the department determines an application is eligible under section 4 of this chapter, the applicant may submit a proposed voluntary remediation work plan to the department.
- (b) A proposed voluntary remediation work plan must include the following:
 - (1) Detailed documentation of the investigation conducted by the applicant in preparing the proposed voluntary remediation work plan and a description of the work to be performed by the applicant to determine the nature and extent of the actual or threatened release.
 - (2) A proposed statement of work to accomplish the remediation in accordance with guidelines established by the department.
 - (3) Plans concerning the following:
 - (A) Quality assurance for the implementation of the proposed remediation project.
 - (B) Descriptions of sampling and analysis.
 - (C) Health and safety considerations.
 - (D) Community relations.
 - (E) Data management and record keeping.
 - (F) A proposed schedule concerning the implementation of all tasks set forth in the proposedstatement of work.

13-25-5-8. Voluntary Remediation: Voluntary remediation agreement - Failure to reach agreement. -

- (a) Before the department evaluates a proposed voluntary remediation work plan, the applicant who submitted the work plan and the commissioner must enter into a voluntary remediation agreement that sets forth the terms and conditions of the evaluation and the implementation of the work plan. A voluntary remediation agreement must include the following:
 - (1) Provisions for the following:

- (A) A requirement that the department provide the applicant with an itemized list of estimated costs the department may incur under this chapter.
- (B) The recovery of all reasonable costs that:
 - (i) are incurred by the department in the review and oversight of the work plan;
 - (ii) are attributable to the voluntary remediation agreement; and
 - (iii) exceed the fee submitted by the applicant under section 2 of this chapter.
- (C) A schedule of payments to be made by the applicant to the department to recover the costs to the department.
- (2) A mechanism to resolve disputes arising from the evaluation, analysis, and oversight of the implementation of the work plan, including any of the following:
 - (A) Arbitration.
 - (B) Adjudication under IC 4-21.5.
 - (C) A dispute resolution procedure provided under the Indiana Rules of Court.
- (3) A provision concerning the indemnification of the Parties.
- (4) A provision concerning the retention of records.
- (5) A timetable for the department to do the following:
 - (A) Reasonably review and evaluate the adequacy of the work plan.
 - (B) Make a determination concerning the approval or rejection of the work plan.
- (6) A provision concerning applicable interagency coordination.
- (7) Any other conditions considered necessary by the commissioner or the applicant concerning the effective and efficient implementation of this chapter.
- (b) If any agreement is not reached between an applicant and the commissioner within a reasonable time after good faith negotiations have begun between the applicant and the commissioner:
 - (1) the applicant or the commissioner may withdraw from the negotiations; and
 - (2) the department shall refund any unexpended portion of the applicant's application fee.

13-25-5-9. Voluntary Remediation: Review and evaluation by department - Recommendation - Request for information. -

- (a) After the commissioner and an applicant have signed a voluntary remediation agreement described under section 8 of this chapter, the department or a person under contract with the department shall do the following:
 - (1) Review and evaluate the site and the affected area surrounding the site.
 - (2) Review and evaluate the documentation of the investigation and feasibility study conducted by the applicant or the applicant's representative for accuracy and thoroughness.
 - (3) Review and evaluate the proposed voluntary remediation work plan for quality, efficiency, and safety based on guidelines established by the department.
 - (4) Make a recommendation to the commissioner concerning whether the commissioner should
 - (A) approve;
 - (B) modify and approve; or
 - (C) reject;

the proposed voluntary remediation work plan.

(b) At any time during the evaluation of a proposed voluntary remediation work plan, the commissioner or the department may request that an applicant submit additional or corrected information to the

department. An applicant may:

- (1) comply with the request; or
- (2) withdraw the applicant's proposed voluntary remediation work plan from consideration.

13-25-5-10. Voluntary Remediation: Approval, modification, or rejection of work plan. -

Subject to section 11 of this chapter, after receiving a recommendation under section 9 of this chapter, the commissioner shall:

- (1) approve;
- (2) modify and approve; or
- (3) reject;

the proposed voluntary remediation work plan.

13-25-5-11. Voluntary Remediation: Notification of local government units and public - Comment period - Public hearing. -

- (a) Before the commissioner approves or rejects a proposed voluntary remediation work plan under section 10 of this chapter, the commissioner must:
 - (1) notify local government units located in a county affected by the proposed voluntary remediation work plan of the work plan;
 - (2) provide that a copy of the proposed voluntary remediation work plan be placed in at least one
 - (1) public library in a county affected by the work plan; and
 - (3) publish a notice requesting comments concerning the proposed voluntary remediation work plan.
- (b) A comment period of at least thirty (30) days must follow publication of a notice under this section. During a comment period, interested persons may do the following:
 - (1) Submit written comments to the commissioner concerning the proposed voluntary remediation work plan.
- (2) Request a public hearing concerning the proposed voluntary remediation work plan. (c) If the commissioner receives at least one (1) written request, the commissioner may hold a public hearing in the geographical area affected by the proposed voluntary remediation work plan on the question of whether to approve or reject the work plan. The commissioner shall consider all written comments and public testimony.

13-25-5-12. Voluntary Remediation: Rejection of work plan - Notice to applicant - Appeal. -

If the commissioner rejects a proposed voluntary remediation work plan under this section 10 of this chapter:

- (1) the commissioner shall, under applicable provisions set forth in IC 4-21.5-3-5(b) and IC 4-
- 21.5-3-5(c), notify the applicant and specify the reasons for rejecting the work plan; and
- (2) the applicant may appeal the commissioner's decision under IC 4-21.5.

13-25-5-13. Voluntary Remediation: Notice of approval, or modification and approval of work plan.-

If the commissioner approves or modifies and approves a proposed voluntary remediation work plan under this chapter, the commissioner shall notify the applicant in writing, under the applicable provisions set forth in IC 4-21.5-3-5(b) and IC 4-21.5-3-5(c), of the following:

- (1) That the voluntary remediation work plan has been approved or modified and approved.
- (2) The date:
 - (A) the applicant may begin implementing the work plan; and
 - (B) by which the work plan must be completed.
- (3) The applicant's right to appeal the commissioner's decision under IC 4-21.5.

13-25-5-14. Voluntary Remediation: Notice of intent to implement work plan. -

If an applicant who submitted an approved voluntary remediation work plan desires to proceed with the implementation of the work plan, the applicant must notify the commissioner in writing not more than sixty (60) days after the work plan is approved that the applicant:

- (1) intends to proceed with the implementation of the work plan; and
- (2) agrees to the starting and completion dates set forth by the commissioner under subsection 13(2) of this chapter.

13-25-5-15. Voluntary Remediation: Oversight and review of implementation by department - Reports to commissioner. -

If the applicant who submitted an approved voluntary remediation work plan proceeds with the work plan, the department or a person under contract with the department shall do the following:

- (1) Oversee and review the implementation of the voluntary remediation work plan.
- (2) Make regular reports to the commissioner concerning the remediation.

13-25-5-16. Voluntary Remediation: Certificate of completion. -

- (a) If the commissioner determines that an applicant has successfully completed a voluntary remediation work plan approved under this chapter, the commissioner shall certify that the work plan has been completed by issuing the applicant a certificate of completion.
- (b) The issuance of a certificate of completion under this section is a final agency action for purposes of IC 4-21.5.
- (c) A person who receives a certificate under this section shall attach a copy of the certificate to the recorded deed that concerns the property on which the remediation took place.

13-25-5-17. Voluntary Remediation: Notice applicant has not successfully completed work plan. -

If the commissioner determines that the applicant has not successfully completed a voluntary remediation work plan approved under this chapter, the commissioner shall notify the applicant of this determination un IC 4-21.5

13-25-5-18. Voluntary Remediation: Covenant not to sue - Actions prohibited during implementation. -

- (a) If the commissioner issues a certificate to a person under section 16 of this chapter, the governor shall also provide the person with a covenant not to sue for:
 - (1) any liability, including future liability; or
 - (2) a claim;

resulting from or based upon the release or threatened release of a hazardous substance or petroleum that is the subject of the approved voluntary remediation work plan successfully conducted under this chapter.

- (b) A covenant not to sue issued under this section shall bar suit against:
 - (1) any person who received the certificate of completion under section 16 of this chapter; or

- (2) any other person who receives the certificate of completion;
 - (A) through a legal transfer of the certificate of completion; or
- (B) by acquiring property to which the certificate of completion applies; from all public or private claims arising under this title or rules adopted under this title in connection with the release or threatened release of a hazardous substance or petroleum that was the subject of the approved voluntary remediation work plan, except as provided in subsection (c).
- (c) A covenant not to sue issued under this section may not apply to future liability for a condition or the extent of a condition that:
 - (1) was present on property that was involved in an approved and completed voluntary remediation work plan; and
 - (2) was not known to the commissioner at the time the commissioner issued the certificate of completion under section 16 of this chapter.
- (d) Except as:
 - (1) provided under federal law; or
 - (2) agreed to by a federal governmental entity;

a covenant not to sue issued under this section may not release a person from liability to the federal government for claims based on federal law.

- (e) During the implementation of an approved voluntary remediation work plan, a person may not bring an action, including an administrative action, against a person implementing the voluntary work plan for any cause of action:
 - (1) arising under this title or rules adopted under the title; and
 - (2) relating to the release or threatened release of a hazardous substance or petroleum that is the subject of the voluntary remediation work plan.

13-25-5-19. Voluntary Remediation: Withdrawal of approval of work plan. -

This chapter does not prohibit or limit the commissioner from withdrawing the commissioner's approval of a voluntary remediation work plan at any time during the implementation of the work plan if:

- (1) the person implementing the work plan fails substantially to comply with the terms and conditions of:
 - (A) the voluntary remediation work plan; or
 - (B) a voluntary remediation agreement; or
- (2) a hazardous substance or petroleum becomes an imminent and substantial threat to human health or the environment. [P.L.87-1992, § 3.]

13-25-5-20. Voluntary Remediation: Claims against third parties - Liability for matters addressed in work plan or certificate of completion. -

- (a) This chapter does not affect an action or a claim, including a claim for contribution, that a person who implements or completes an approved voluntary remediation work plan has or may have against a third party.
- (b) A person who implements or completes an approved voluntary remediation work plan under this chapter may not be held liable for claims for contribution concerning matters addressed in:
 - (1) the work plan; or
 - (2) a certificate of completion issued to the person under section 16 of this chapter.

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13-25-5-21. Voluntary Remediation: Voluntary remediation fund. -

- (a) The voluntary remediation fund is established to provide a source of funds for the department to implement this chapter.
- (b) The expenses of administering the fund shall be paid from the money in the fund.
- (c) The treasurer of state shall invest the money in the fund not currently needed to meet the obligations of the fund in the same manner as other public funds may be invested. Interest that accrues from these investments shall be deposited in the fund.
- (d) Money in the fund at the end of a state fiscal year does not revert to that state general fund.
- (e) The sources of money for the fund are as follows:
 - (1) Fees paid under section 2 of this chapter.
 - (2) Appropriations made by the general assembly.
 - (3) Gifts and donations intended for deposit in the fund.
 - (4) Transfers under section 22 of this chapter from the environmental management special fund established under IC 13-14-12-1.

13-25-5-22. Voluntary Remediation: Transfer from environmental management special fund -Reimbursement [expires August 1, 1998]. -

- (a) Two hundred fifty thousand dollars (\$250,000) shall be transferred from the environmental management special fund established by IC 13-14-12-1 to the voluntary remediation fund on July 1, 1992, to be used to implement this chapter.
- (b) Beginning July 1, 1994, the money transferred under subsection (a) shall be reimbursed to the environmental management special fund with money in the voluntary remediation fund. Sixty-two thousand five hundred dollars (\$62,500) shall be transferred per year. Money transferred under this subsection must come from the balances remaining in the voluntary remediation fund at the end of each state fiscal year. (c) This section expires August 1, 1998.

13-25-5-23. Voluntary Remediation: Adoption of rules. -

The board may adopt rules under IC 4-22-2 and IC 13-14-8 to implement this chapter. The rules may include interim or final remediation standards or provisions limiting the liability of lenders associated with persons involved in voluntary remediation projects under this chapter.

APPENDIX H: ADDENDUM SUPERFUND MEMORANDUM OF AGREEMENT - BROWNFIELDS AND VOLUNTARY REMEDIATION PROGRAM

For Immediate Release: December 4, 1995

IDEM Commissioner Kathy Prosser today signed a Memorandum of Agreement with the U.S. Environmental Protection Agency that establishes federal approval of environmental cleanups under Indiana's Voluntary Remediation Program.

"This agreement removes the last major stumbling block for our voluntary cleanup efforts," said Commissioner Prosser. "Some property owners have been concerned that EPA would not accept cleanups done under our program. The MOA I am signing today erases that fear, and should help Indiana return many industrial and commercial properties to productive use."

In 1993, IDEM established one of the nation's first voluntary remediation programs. Through the program companies receive state approval for cleanups done voluntarily. Currently, 52 sites are being cleaned up in Indiana under the program.

Although IDEM's Voluntary Remediation Program is viewed in a positive light, some businesses and lenders have expressed concern about liability under the federal Superfund law.

Under the agreement, Region V agrees that when an Indiana site has been investigated or remediated under Indiana's program and IDEM has issued a Certificate of Completion for the site, EPA will not plan or anticipate any federal action under the Superfund law. In exceptional circumstances, EPA reserves the right to intervene if the site poses an imminent and substantial threat to human health or the environment.

The agreement does not apply to sites on the Superfund National Priority list or site currently subject to orders or enforcement under Superfund law.

Indiana is the fourth state in the nation to establish such an agreement, joining the states of Illinois, Minnesota and Wisconsin.

Introduction

IDEM and U.S. EPA, Region V, recognize that the revitalization of contaminated or potentially contaminated properties (Brownfields) will provide a significant benefit to both the environment and the economy of the local communities. To the extent possible, Region V and IDEM seek to facilitate the productive use of industrial and commercial properties by addressing regulatory impediments to the financing, transfer, and appropriate reuse of these properties. Both agencies recognize that a key factor to meet this goal is to exercise their authorities and use their resources in ways that are mutually complementary and are not duplicative. In particular, IDEM and Region V seek to protect human health and the environment by encouraging the voluntary investigation and cleanup of properties in Indiana by implementing the following strategic goals:

1. Promoting appropriate investigations and cleanups by parties participating in the Voluntary Remediation Program (VRP).

2. Developing partnerships between Region V, IDEM, other federal, state, local governmental agencies, and key external stakeholders in Indiana, including representatives from citizen/community groups and the private sector.

- 3. Providing necessary information to the key stakeholders in Indiana to allow for informed decision-making by property owners, prospective purchasers, lenders, public and private developers, citizens, municipalities, counties and elected officials.
- 4. Promoting the adequate remediation and revitalization of contaminated or potentially contaminated properties in Indiana for an appropriate use as determined by the key stakeholders.

In order to accomplish these goals, Region V intends to assist IDEM in further expanding the use of the VRP. Region V recognizes that the VRP has been developing and implementing successful strategies to help promote the voluntary investigation and cleanup of under-utilized properties. Similarly, IDEM intends to assist and support efforts to promote and implement Region V's Brownfields activities. IDEM recognizes Region V as a key partner in the ongoing success of state voluntary cleanup programs, including the VRP, and the role of Region V in addressing the uncertainty of financing, transferring and developing Brownfields sites by clarifying the risk of federal liability.

Principles

When a site in Indiana has been investigated or remediated in accordance with the practices and procedures of the VRP and IDEM has issued a Certificate of Completion for the site, Region V will not plan or anticipate any federal action under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund) unless, in exceptional circumstance, the site poses an imminent and substantial threat to human health or the environment. In all cases, the Region V decision will be based strictly on the information available at the time of IDEM determination. The foregoing principle does not apply to sites listed on the NPL or sites currently subject to orders or enforcement actions under Superfund law.

Region V will continue to work with IDEM to remove any concerns associated with federal activity under Superfund so as to encourage the financing, transfer and appropriate redevelopment and use of industrial and commercial property. In addition, Region V will continue to provide technical assistance and, in its discretion, financial support to local and state governmental agencies in order to facilitate the revitalization of contaminated or potentially contaminated properties in Indiana.

Reporting

On an annual basis, IDEM will report to Region V on the following:

- 1. Number of sites in the VRP.
- 2. Sites entering the VRP in the previous year.
- 3. Sites having received Certificates of Completion in the previous year.

Several operational factors are important and will complement the mutual objectives of both IDEM and Region V:

- 1. IDEM has successfully operated a Voluntary Remediation Program (VRP) since 1993.
- 2. Region V and IDEM find the VRP provides for response actions that are protective of human health and the environment.
- 3. Region V and IDEM find the VRP provides adequate opportunities for public involvement and technical assistance.
- 4. At sites successfully completing a remediation under the VRP, Region V does not plan or anticipate any federal action under the Superfund law (CERCLA) unless, in exceptional circumstances, the site poses an imminent threat to human health and the environment.
- 5. The State of Indiana and IDEM have made a substantial commitment to the VRP and the revitalization of contaminated property (Brownfield's redevelopment) by, among other things, passage of House Resolution 40 establishing an Interim Study Committee for Brownfields issues and the establishment of a Brownfields Coordinator position at IDEM.
- 6. Region V will continue to work with IDEM to remove any concerns associated with federal activity under Superfund so as to encourage the financing, transfer, and appropriate redevelopment and use of industrial and commercial property.
- 7. Region V will continue to provide technical assistance and, at its discretion, financial support to local and state Governmental agencies in order to facilitate the revitalization of contaminated or potentially contaminated properties in Indiana.